

# Module 1

## What Is a Prompt?

### Definition of a Prompt

- A **prompt** is any input provided to a generative model to produce a desired output.
- It serves as an **instruction** to guide the model's response.
- Examples of prompts:
  - **Text generation:** "Write a small paragraph describing your favorite holiday destination."
  - **Code generation:** "Write HTML code to generate a dropdown selection of cities within an online form."
  - **Step-by-step refinement:** "Write a short story about a scientist studying life on Mars. What were some of the challenges he faced?"

### Importance of Effective Prompting

- Prompts help generative AI models produce **relevant, contextual, imaginative, and linguistically accurate** output.
- Effective prompts ensure **clear and logical** responses.
- Poorly structured prompts lead to **generic or irrelevant** results.

### Types of Prompting

#### Naïve Prompting

- **Simplistic queries** that lack context or structure.
- Example:
  - **Prompt:** "Rich man's story from a small town, his struggles and achievements."
  - **Issue:** Produces a **generic** and **vague** output.

#### Structured Prompting

- **Well-defined instructions** with proper context and details.
- Example:
  - **Prompt:** "Write a short story about the struggles and achievements of a farmer who became a rich and influential businessman in 10 years."
  - **Improvement:** Provides **specific details** and **clear objectives**.

#### Detailed Image Prompting

- **Brief and unclear prompts** may not generate the desired output.
- Example:
  - **Prompt:** "Sunset image between mountains."
  - **Issue:** Lacks **details** about colors, scenery, and composition.
- Improved prompt:

- "Generate an image depicting a calm sunset above a river valley that rests amidst the mountains."

# Building Blocks of a Well-Constructed Prompt

## 1. Instructions

- Provides **clear guidelines** on what the model should do.
- Directs the AI model's **actions and response formation**.
- Example:
  - "Write an essay in 600 words, analyzing the effects of global warming on marine life."

## 2. Context

- Helps establish the **background** and **framework** for the output.
- Example of adding context:
  - **Before:** "Write an essay in 600 words analyzing the effects of global warming on marine life."
  - **After:**
    - *"In recent decades, global warming has undergone significant shifts, leading to rising sea levels, increased storm intensity, and changing weather patterns. These changes have had a severe impact on marine life. Write an essay in 600 words analyzing the effects of global warming on marine life."*
  - **Improvement:** Provides **background knowledge** to guide the AI model.

## 3. Input Data

- Additional **specific data** that helps refine the output.
- Example:
  - **Before:** "Write an essay in 600 words analyzing the effects of global warming on marine life."
  - **After:**
    - *"You have been provided with a dataset containing temperature records and measurements of sea levels in the Pacific Ocean. Write an essay in 600 words analyzing the effects of global warming on marine life in the Pacific Ocean."*
  - **Improvement:** Helps the AI **use relevant details** to improve accuracy.

## 4. Output Indicators

- Defines **how the output should be structured** and evaluated.
- Specifies aspects like **tone, length, style, and evaluation criteria**.
- Example:
  - **Prompt:** "Write an essay in 600 words analyzing the effects of global warming on marine life."
  - **Output Indicator:**
    - Specifies **word count (600 words)**.

- Evaluates **clarity, analysis depth, and incorporation of relevant case studies**

## Key Takeaways

- A **prompt** is an input or series of instructions given to an AI model to produce a desired output.
- **Effective prompting** improves AI responses and ensures accuracy.
- The **four key elements** of a well-structured prompt are:
  1. **Instructions** – Direct the AI model's response.
  2. **Context** – Provides background and enhances relevance.
  3. **Input Data** – Offers reference points for more specific responses.
  4. **Output Indicators** – Define the expected output style, length, and evaluation criteria.

## What is Prompt Engineering?

### Definition of Prompt Engineering

- The process of designing effective prompts to generate better and desired responses.
- Ensures generative AI models produce relevant and accurate results.
- Involves critical analysis, creativity, and technical acumen.
- Goes beyond asking the right question; includes framing it with context, relevant information, and expected outcomes.

### Importance of Prompt Engineering

- **Optimizing Model Efficiency:** Helps users utilize AI models effectively without extensive retraining.
- **Boosting Performance for Specific Tasks:** Enables generative AI models to provide more nuanced and context-aware responses.
- **Understanding Model Constraints:** Helps identify model strengths and weaknesses for future improvements.
- **Enhancing Model Security:** Prevents harmful content generation by refining prompt design.

### Example: Weather Forecasting for a Ship Captain

- A ship captain requires an accurate weather forecast.
- A simple prompt like *"Weather forecast of the Atlantic Ocean"* may yield vague results.
- A well-structured prompt should include:
  - **Context:** Specify location (latitude and longitude) and time range.
  - **Desired Output:** Include details on wind patterns, wave heights, precipitation, cloud cover, and storms.
- **Refined Prompt Example:**  
*"To help plan an effective navigation in the Atlantic Ocean, provide detailed information about expected wind patterns, wave heights, precipitation probabilities,*

*cloud cover, and any potential storms that might affect the voyage during a specified time frame and location."*

## The Process of Prompt Engineering

1. **Define the Goal**
  - Establish a distinct objective.
  - Example: *"Form a brief overview of the benefits and risks associated with artificial intelligence in automobiles."*
2. **Craft the Initial Prompt**
  - Construct the prompt as a question, directive, or situation.
  - Example: *"Write an article that presents a well-rounded analysis of the benefits and drawbacks associated with the incorporation of artificial intelligence in the automobile industry."*
3. **Test the Prompt**
  - Analyze the response to see if it meets the desired criteria.
  - Example Issue: The initial response lacks discussion on ethical concerns and implications.
4. **Analyze the Response**
  - Review the output and determine its shortcomings.
  - Example: *"The initial prompt does not cover a comprehensive range of benefits and risks."*
5. **Refine the Prompt**
  - Enhance specificity, add context, or rephrase for clarity.
  - Refined Example:  
*"Write an informative article discussing the role of artificial intelligence in revolutionizing the automobile industry. Address key aspects such as benefits, drawbacks, ethical considerations, and both positive and negative implications. Cover specific domains like autonomous driving and real-time traffic analysis, while also examining potential challenges such as technical complexity and cybersecurity concerns."*
6. **Iterate the Process**
  - Repeat the last three steps until the response aligns with the goal.
  - Final Prompt Example:  
*"Write an article highlighting how artificial intelligence is reshaping the automobile industry, focusing on the positive advancements, particularly in autonomous driving and real-time traffic analysis, while thoroughly exploring concerns related to intricate technical aspects such as decision-making algorithms and potential cybersecurity breaches. Emphasize the implications these concerns may have on vehicle safety. Ensure that the analysis is thorough, backed with examples, and encourages critical thinking."*

## Summary

- **Prompt engineering** helps optimize AI model responses.
- **The process** includes defining goals, crafting prompts, testing, analyzing, refining, and iterating.
- **Importance** includes improving efficiency, task-specific performance, security, and understanding model constraints.

# Best Practices for Prompt Creation

Writing effective prompts is crucial for utilizing the full potential of generative AI models to produce relevant and accurate responses. By applying best practices for creating effective prompts, you can supervise the style, tone, and content of the generated output.

## Key Dimensions for Crafting Effective Prompts

Best practices for crafting effective prompts can be applied across four essential dimensions:

1. **Clarity**
2. **Context**
3. **Precision**
4. **Role Play or Persona Pattern**

Let's explore each of these aspects individually.

### 1. Clarity

To ensure clarity in your prompts, consider the following points:

- Use simple and straightforward language to convey instructions easily.
- Avoid ambiguity and ensure the prompt is easy to comprehend.
- Avoid specialized terminologies that may confuse the model or users.
- Provide a clear description of the task to align the response with your intentions.

**Example:** ✗ *Discuss culinary processes that take place on foliaceous stipules of plants with the help of sunlight, also mention a green thing and how light, air, and water are important for aerial parts of the plant.*

- This prompt is ambiguous and contains complex terminologies, making it difficult to comprehend.

✓ *Explain the process of photosynthesis in plants, detailing the role of chlorophyll and how sunlight, carbon dioxide, and water contribute to this biological function.*

- The revised prompt is clear, simple, and explicitly states the intended discussion.

### 2. Context

Providing context helps the model understand the situation or subject. This includes:

- Brief introductions or explanations of the circumstances.
- Relevant information or specific details about people, places, events, or concepts.

**Example:** ✗ *Write what happened during the outbreak of the Revolutionary War in 1775.*

- This prompt lacks sufficient context and specific details.

✓ *Describe the historical events leading to the American Revolutionary War, focusing on key incidents like the Boston Tea Party and Battle of Saratoga. Highlight tensions between the American colonies and the British government and explain how these events led to the outbreak of war in 1775.*

- The revised prompt provides proper background and relevant details.

### 3. Precision

Precision helps outline your request clearly and ensures the response aligns with your expectations. To enhance precision:

- Be explicit about the kind of response you need.
- Provide examples to guide the model's thought process.

**Example:** ✗ *Talk about supply and demand and how it is affected in economics.*

- This prompt lacks specificity and examples.

✓ *Explain the concept of supply and demand in economics. Describe how an increase in demand influences pricing using an example like the smartphone market. Also, explain the impact of reduced supply on pricing by referencing disruptions in oil production.*

- The refined prompt is precise and includes examples for better understanding.

### 4. Role Play or Persona Pattern

Prompts written from a specific character or profession's perspective can generate responses that align with that persona. Essential contextual details help the model assume the role effectively.

**Example:** ✗ *Write a log entry describing the strange flora and fauna of an uncharted alien planet.*

- This prompt provides general scientific details but lacks a defined perspective.

✓ *Pretend you are an astronaut who has just landed on an uncharted alien planet. Write a log entry describing the strange flora and fauna you've encountered, including the sky color and the unfamiliar sounds echoing through the alien landscape. Express your excitement, curiosity, and a hint of apprehension as you document this extraordinary journey.*

- The refined prompt explicitly assumes a persona, leading to a more immersive and aligned response.

## Conclusion

In summary, writing effective prompts for generative AI models is essential for controlling the style, tone, and content of the output. Best practices for writing effective prompts can be implemented across four dimensions:

- **Clarity:** Use simple and concise language.
- **Context:** Provide background information and relevant details.
- **Precision:** Be specific and incorporate examples.
- **Role Play:** Assume a persona and offer relevant context.

## Naive Prompting and the Persona Pattern

By now, you should have a clear understanding of the opportunity and value that conversational AI offers. You have also learned how prompts can be adjusted or optimized to produce desired responses when conversing with an AI model.

### *The Naïve Approach*

The standard or naive approach involves querying the AI in the simplest way possible, as most users would. The results are generally acceptable, but a simple adjustment can significantly improve them.

Example:

- **Naïve Prompt:** *What is the best way to get fit?*
- **Persona-Based Prompt:** *Acting as a fitness expert, tell me the best way to get fit.*

### *Enhancing Prompts with a Persona*

Adding a persona improves the AI's response. A well-structured persona prompt consists of three parts:

1. Defining the role (e.g., fitness expert, historian, scientist).
2. Specifying the knowledge source or expertise level.
3. Formatting the response accordingly.

Example:

- **Prompt Instructions:** *You will act as a fitness expert who is current with the latest research and provide detailed step-by-step instructions in response to my queries.*
- **Query:** *Create a gym workout program to lose weight and build strength for an out-of-shape beginner.*

### *Using a Famous Persona*

You can instruct the AI to mimic the style of a famous figure for a more specific response. For example:

- **Naïve Prompt:** *Give me a list of 10 article titles to promote my new book about dog training.*
- **Persona-Based Prompt:** *Acting as marketing expert Seth Godin, give me a list of 10 article titles to promote my new book about dog training.*

### *Exercises*

1. Try creating a naive prompt and then improve it by adding a persona.
2. Request two different responses by specifying two personas with contrasting viewpoints.
  - Example: *Act as a liberal political expert and as a conservative political expert and provide two answers to my question.*
3. Ask thought-provoking questions such as: *Which policies should be implemented to address inflation?*

## Common Prompt Engineering Tools

Welcome to *Common Prompt Engineering Tools*. After watching this video, you'll be able to:

- Describe the common functionalities of prompt engineering tools.
- Explain the capabilities of a few common tools for prompt engineering.

### Introduction to Prompt Engineering Tools

Prompt engineering is the process of designing accurate and contextually appropriate prompts to interact with generative AI models to generate relevant and accurate outputs. Various prompt engineering tools are available to assist in this process, particularly for users who may not be proficient in natural language processing (NLP) but want to achieve specific outcomes with AI models.

### Common Functionalities of Prompt Engineering Tools

These tools offer various features to optimize prompt creation:

- **Prompt Suggestions:** Recommend prompts based on a given input or desired output.
- **Structural Guidance:** Help in structuring prompts for better contextual communication.
- **Iterative Refinement:** Allow continuous improvement of prompts based on responses.
- **Bias Mitigation:** Help in crafting prompts that reduce the likelihood of biased or inappropriate responses.
- **Domain-Specific Prompts:** Provide pre-built prompts tailored for specific fields like legal, medical, or technical domains.
- **Libraries of Predefined Prompts:** Offer reusable prompts for various use cases.



## Popular Prompt Engineering Tools

### 1. *IBM Watsonx.ai*

- A platform integrating tools to train, tune, deploy, and manage foundation models.
- Includes **Prompt Lab**, enabling users to experiment with different foundation models.
- Provides sample prompts for summarization, classification, generation, and extraction.
- Allows users to train models by adding instructions and examples to guide responses.

### 2. *Spellbook (by Scale AI)*

- An integrated development environment (IDE) for building applications based on large language models (LLMs).
- Features a **Prompt Editor** to edit and test prompts.
- Supports use cases like text generation, extraction, classification, question answering, auto-completion, and summarization.
- Includes **Prompt Templates** and pre-built prompts for various applications.

### 3. *Dust*

- A web-based interface for writing and chaining prompts together.
- Enables version control for prompt chains.
- Provides a custom coding language and standard blocks for processing LLM outputs.
- Supports **API integration** for connecting with other AI models and services.

### 4. *PromptPerfect*

- Optimizes prompts for different LLMs and text-to-image models.
- Supports models such as **GPT, Claude, StableLM, Llama, DALL-E, and Stable Diffusion**.
- Offers **Auto-Complete** for writing prompts efficiently.
- Provides a **Streamline Mode** for step-by-step prompt refinement.

## Additional Resources for Prompt Engineering

- **GitHub:** Offers repositories with guides, examples, and tools for prompt engineering.
- **OpenAI Playground:** A web-based tool for testing prompts with OpenAI models like GPT.
- **Playground AI:** Helps experiment with text prompts for generating images using **Stable Diffusion**.
- **LangChain:** A Python library for building and chaining prompts efficiently.

## Buying & Selling Prompts

- **PromptBase** is a marketplace for buying and selling AI prompts.
- Supports models like **Midjourney, ChatGPT, DALL-E, Stable Diffusion, and Llama**.
- Users can purchase prompts for specific tasks or sell their crafted prompts.

## Conclusion

In this video, you learned that:

- Prompt engineering tools optimize prompt creation with functionalities like **suggestions, contextual structuring, iterative refinement, and bias mitigation**.
- Popular tools include **IBM Watsonx.ai, Spellbook, Dust, and PromptPerfect**.
- Additional resources like **GitHub, OpenAI Playground, LangChain, and PromptBase** help in learning and monetizing prompt engineering.

By utilizing these tools, you can effectively design prompts to achieve optimal AI-generated responses.

## Best Practices for Writing Effective Prompts

### Importance of Prompt Engineering

Prompt engineering is a crucial step when using generative AI, as it allows users to interact with the model and obtain the desired outcome. Writing clear and specific prompts enhances the quality and accuracy of responses.

### Key Guidelines for Writing Prompts

#### *1. Be Clear and Specific*

- Use precise language to articulate your request.
- Avoid open-ended or ambiguous phrasing.
- Clearly define the application and expected features in the response.

#### *2. Provide Context*

- Include background information relevant to the query.
- Specify the role or expertise level, e.g., *"Acting as a healthcare expert, explain the symptoms of diabetes."*
- Use examples to illustrate the desired response style or structure.

#### *3. Use Natural Language*

- Keep language simple and avoid complex or vague terminology.
- Ensure the model understands the intent behind your prompt.

#### *4. Experiment with Prompt Length*

- Short prompts may work for simple tasks.
- Longer, detailed prompts are better for complex queries.

## ***5. Iterate and Refine***

- Continuously test and modify prompts to improve responses.
- Ask follow-up questions or request refinements if needed.
- Use iterative prompting to fine-tune results.

## ***6. Provide Constraints and Guidelines***

- Set limitations on output length or response format.
- Define specific response structures if required.
- Balance model creativity with context relevance.

## ***7. Ask the Model for Prompting Tips***

- If unsure, ask the AI how to best phrase your prompt.
- Example: *"What is the best way to prompt you to generate a flowchart?"*

## **Conclusion**

Writing effective prompts is an art that requires clarity, structure, and iteration. By following these best practices, you can optimize AI-generated responses and unlock creative possibilities. Keep refining your approach to get the best results!

# **Prompt Engineering: Expert Insights and Techniques**

## **Introduction to Prompt Engineering**

Prompt engineering is the technique of crafting effective prompts to generate consistent and high-quality outputs from AI models. The key elements of prompt engineering include:

- **Clarity of Thought:** Clearly defining the intent of the query.
- **Contextual Information:** Providing relevant background for better responses.
- **Feature Specification:** Listing required features to refine output.

Prompt engineering has gained prominence with the rise of generative AI. The fundamental goal is to understand how to interact with large language models (LLMs) to achieve desired results.

## **Types of Prompting Techniques**

### ***1. Zero-Shot Prompting***

- A straightforward query without any examples.
- Commonly used in tools like ChatGPT.
- Example: *"Explain quantum computing."*

## **2. One-Shot Prompting**

- Provides one example to guide the model.
- Example: *"Here's an example of a product description. Now, write a similar one for another product."*

## **3. Few-Shot Prompting**

- Includes multiple examples to improve output quality.
- Examples don't need to be perfect, just well-structured.
- AI can generate additional examples based on given data.

## **4. Chain-of-Thought Prompting**

- Guides the model through a step-by-step process.
- Helps with complex tasks by breaking them into logical sequences.
- Example: *"Outline the steps needed to build a website from scratch."*

## **5. Role-Based Prompting**

- Assigns a persona to the AI for tailored responses.
- Examples:
  - *"As a JavaScript expert, explain async/await."*
  - *"Act as a marketing strategist and create an ad campaign."*

## **Iterative Feedback and Fine-Tuning**

- Provides feedback to improve responses.
- Refines prompts based on previous outputs.
- Helps reduce trial and error, saving time and resources.

## **Common Prompt Engineering Tools**

### **1. Watsonx Studio Prompt Engineering Lab**

- Ideal for experimenting with and refining prompts.
- Helps develop application-specific prompts.

### **2. OpenAI & Microsoft Copilot**

- Offer guidelines on crafting effective prompts.
- Allow users to test and refine AI-generated responses.

## **Optimizing AI Model Outputs**

- **Adjusting Model Parameters:**
  - *Temperature, top-k, and top-p* control creativity and randomness.
- **Providing Structured Input:**
  - Example: Formatting data for better understanding by the AI.

- **Understanding Model Syntax:**
  - Certain models, like Llama2, require specific syntax for optimal results.

## Practical Example

- A user working with ChatGPT wanted to analyze a workflow.
- The model suggested structuring the input for better understanding.
- The user followed the recommendation, leading to more accurate outputs.

## Conclusion

Prompt engineering is an essential skill for maximizing AI capabilities. Learning and applying different prompting techniques can improve the efficiency and accuracy of AI-generated responses while reducing trial and error. Investing time in mastering prompt engineering will lead to better and more useful interactions with AI models.

# Module 2:

## Text-to-Text Prompt Techniques

### Introduction

Advancements in **Natural Language Processing (NLP)** and **Large Language Models (LLMs)** have raised concerns about **reliability, security, and biases**. An effective solution is **text prompts**, which guide LLMs to generate desired outputs. The effectiveness of these prompts impacts response quality. Below, we explore various techniques that enhance LLM reliability and output accuracy.

### Techniques for Effective Text Prompts

#### *1. Task Specification*

Clearly define the objective to improve accuracy.

- Example: *"Translate this English sentence into French."*

#### *2. Contextual Guidance*

Provide detailed instructions for relevant responses.

- Generic prompt: *"Write a short paragraph on New York City."*
- Improved prompt: *"Write a short paragraph on New York City, highlighting its iconic landmarks."*

#### *3. Domain Expertise*

Use domain-specific terminology for specialized fields.

- Example: *"Explain the causes, symptoms, and treatments of hypothyroidism, including the latest research."*

#### **4. Bias Mitigation**

Explicitly instruct the model to generate neutral responses.

- Example: *"Write a 100-word paragraph on leadership traits without favoring any gender."*

#### **5. Framing**

Guide the LLM to stay within specific response boundaries.

- Example: *"Provide a 100-word summary of an article on climate change, focusing on key findings and recommendations."*

#### **6. Zero-Shot Prompting**

LLMs generate responses without prior training on the specific prompt.

- Example: *"Select the adjective in this sentence: 'Anita bakes the best cakes in the neighborhood.'"* (Output: **best**)

#### **7. User Feedback Loop**

Iteratively refine prompts based on feedback.

- Example: *"Write a poem."* → (LLM generates poem) → *"Make it more humorous."* → (LLM revises poem accordingly)

#### **8. Few-Shot Prompting**

Provide demonstrations to steer model responses.

- Example:
  - *"Recommend a summer travel destination known for beautiful beaches."*
  - *"Suggest a fall travel destination renowned for its foliage."*
  - New query: *"Recommend a city to explore."* (Output: **Paris, known for its rich history, art, and landmarks**)

### **Benefits of Effective Text Prompts**

1. **Enhances Explainability** – Helps users understand LLM decision-making processes.
2. **Addresses Ethical Concerns** – Ensures compliance with ethical and legal guidelines.
3. **Builds User Trust** – Transparent interactions improve confidence in LLM responses.

## Conclusion

By utilizing techniques such as **task specification, contextual guidance, domain expertise, bias mitigation, framing, zero-shot, few-shot prompting, and user feedback loops**, we can improve the **reliability, accuracy, and transparency** of LLM outputs. These strategies also enhance **explainability, ethical compliance, and user trust** in AI-generated responses.

## Interview Pattern Approach

The lecture discusses the **interview pattern approach** to **prompt engineering** for generative AI models. Here are the key points:

- **Definition:** This approach simulates a conversation, allowing for a more dynamic interaction with the AI model.
- **Process:** It involves optimizing prompts to ensure the model generates precise responses. Users provide specific instructions, and the model asks follow-up questions to gather necessary information.
- **Example:** If you want the model to act as a travel consultant, you would instruct it to ask detailed questions about your travel preferences, which helps in crafting a tailored itinerary.
- **Benefits:** This method is superior to traditional prompting as it fosters a back-and-forth exchange, enhancing the quality of responses.

### Creating a Blog Post with the Interview Pattern

## Using the Interview Pattern for Effective Blog Writing

The Interview Pattern is a powerful approach to enhance content creation. Let's explore how it can be used to craft a compelling blog post to promote our course, *Prompt Engineering for Everyone*.

### Naive Approach

A simple prompt might be:

*Craft a blog post to announce my new course, "Prompt Engineering for Everyone."*

While this generates a post, it often lacks depth and specificity because the AI lacks context about the course beyond its title.

### Enhanced Approach: The Interview Pattern

To improve results, use a more structured prompt:

*You will act as an SEO and content marketing expert. You will interview me, asking relevant questions before crafting the blog post.*

By answering the AI's follow-up questions, the final output becomes more detailed and personalized.

## Alternative Approach

You can also instruct the AI to gather structured responses:

*Ask me a series of questions, one by one, to gather all the necessary information before writing the blog post.*

### Tips for Success

1. **Provide detailed answers** – The Interview Pattern works best when you offer specific information.
2. **Combine with the Persona Pattern** – Using both patterns together leads to richer, more tailored content.
3. **Experiment with instructions** – Slight variations in prompts can yield improved and diverse results.

### Exercises

Try using the Interview Pattern in different scenarios:

1. **Travel Planning:** *Suggest a travel itinerary for my next vacation.*
2. **Recipe Generation:** *Give me a dinner recipe tonight.*
3. **Gift Suggestions:** *Suggest a gift for my friend.*

## Chain of Thought Approach

The current content focuses on the **Chain-of-Thought Approach** in prompt engineering for generative AI. Here are the key points:

- **Definition:** The chain-of-thought approach involves constructing a series of prompts or questions to guide AI models in generating coherent responses.
- **Purpose:** It helps demonstrate the cognitive abilities of generative AI models by breaking down complex tasks into simpler, sequential prompts.
- **Process:**
  - Start with a related question and provide its logical solution.
  - Follow up with another question that can be solved using the same reasoning.
- **Example:**
  - First question: "Mary has eight radishes. She used five for dinner. How many does she have now?"
  - Solution: 3 radishes left after cooking, plus 10 more bought, totaling 13.
- **Outcome:** This method strengthens the model's reasoning process and improves its ability to solve similar problems.



# Chain-of-Thought Approach in Prompt Engineering

## Introduction

The Chain-of-Thought (CoT) methodology enhances AI cognitive performance by breaking down complex tasks into manageable steps. This prompt-based learning approach helps AI models reason effectively by providing example questions and their solutions before presenting related queries.

## When AI Reasoning Goes Wrong

### *Example:*

An Italian menu has five items:

- **Prosciutto** – \$9.99
- **Pecorino** – \$12.99
- **Calamari** – \$13.99
- **Bruschetta** – \$4.99
- **Carpaccio** – \$14.99

**Task:** Spend \$30 to maximize satiety, assuming each item is equally filling.

**Naive AI Response (Incorrect):** Orders a mix of items totaling \$27.97.

**Correct Answer:** Order six Bruschetta (\$4.99 each) for maximum satiety.

## Chain-of-Thought to the Rescue

By structuring the prompt with clear logic, we can guide AI reasoning effectively:

### *Refined Prompt Example:*

**Q:** Spend \$30 on the menu to maximize satiety.

**A:** Since each item is equally filling, prioritize those with the lowest cost-per-satiety ratio:

- **Bruschetta** – \$4.99
- **Prosciutto** – \$9.99
- **Pecorino** – \$12.99
- **Calamari** – \$13.99
- **Carpaccio** – \$14.99

Using integer division:  $\$30 \div \$4.99 \approx 6$  **Bruschetta**.

## Another Example: Maximizing Aquarium Fish Purchase

A store sells:

- **Guppies** – \$3.99

- **Goldfish** – \$1.99
- **Betta** – \$5.99
- **Angelfish** – \$8.99

**Task:** Spend \$20 to maximize the number of fish.  
**Correct Answer:** Buy **10 Goldfish** (\$1.99 each) for a total of **\$19.90**.

## Zero-Shot Chain-of-Thought Prompting

Researchers found that adding specific phrases improves AI reasoning:

- "Let's think step by step."
- "Let's work this out in a step-by-step way to be sure we have the right answer."

These phrases help AI reason more logically but work best when combined with structured prompts.

## Chain-of-Thought for In-Depth Exploration

Instead of generic questions, breaking topics into logical steps enhances AI responses.

*Example: Space Exploration*

### Improved Prompt Instructions:

- Historical Space Missions
- Moon Landing & its Impact on the Cold War
- Satellite Technology's Role in Humanity
- Mars Colonization Possibilities
- Search for Extraterrestrial Life
- Space Tourism Prospects
- Space Debris & Environmental Impact
- International Space Station Collaboration
- Rocket Technology Advancements
- Interstellar Travel Challenges
- Private Companies & Billionaire Involvement

Adding "**Let us think step by step.**" enhances AI responses.

## Conclusion

Using Chain-of-Thought techniques enhances AI reasoning, improving accuracy in problem-solving, decision-making, and knowledge exploration.

# Tree-of-Thought Approach to Prompt Engineering

## Introduction

The *Tree-of-Thought* approach is an innovative technique that expands the capabilities of the *Chain-of-Thought* prompting method. It enables generative AI models to demonstrate advanced reasoning capabilities by structuring prompts in a hierarchical, tree-like format. This method is particularly useful for providing explicit instructions or constraints to ensure AI generates desired outputs, making it effective for tackling complex problems.

## How the Tree-of-Thought Approach Works

- The AI generates multiple lines of thought, resembling a decision tree.
- Unlike traditional linear approaches, it evaluates and pursues multiple paths simultaneously.
- Each thought or idea branches out, creating an interconnected structure.
- The model assesses possible routes, assigning numerical values to predicted outcomes.
- Less promising lines of thought are eliminated, leading to the most favorable choices.

## Example: Recruitment and Retention Strategies

To design an AI-driven recruitment and retention strategy for an e-commerce business, a structured prompt using the *Tree-of-Thought* approach can be employed:

### ***Prompt Instruction:***

"Imagine three different experts answering this question. Each expert writes one step of their thinking and shares it with the group. Then, all experts proceed to the next step. If any expert realizes they are wrong at any point, they exit."

### ***Original Prompt Question:***

*Act as a human resource specialist. Design a recruitment and retention strategy for an e-commerce business, focusing on attracting and retaining skilled remote employees.*

## Benefits of This Approach

- Encourages step-by-step logical thinking.
- Promotes consideration of intermediate thoughts and multiple possibilities.
- Maximizes AI capabilities by enabling structured reasoning.
- Generates more useful and refined results.

## Conclusion

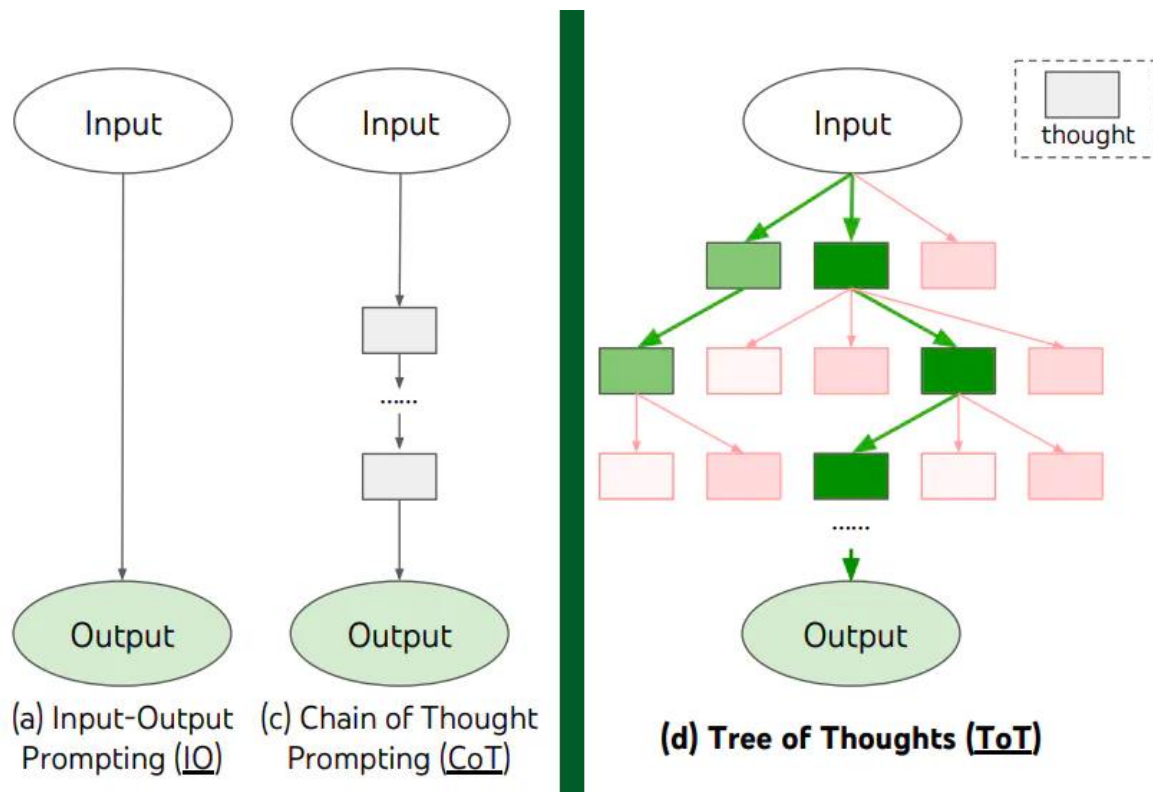
The *Tree-of-Thought* approach builds upon the *Chain-of-Thought* method by structuring prompts hierarchically. It is valuable when explicit instructions are needed for desired outputs, as it enables AI to explore multiple possibilities and ideas simultaneously, branching out like

a decision tree. By leveraging this technique, users can unlock new solutions and optimize AI-generated responses effectively.

## The Tree-of-Thought Approach to Prompt Engineering

At its core, Chain-of-Thought (CoT) prompting solicits a step-by-step thinking process from the LLM. Compared to naive/standard/Input-Output prompting, we get far better results with it.

There are some limitations, however. In a research paper (arXiv:2305.10601), Yao et al. compared various approaches to prompting, including naive prompting, CoT, and a new technique called Tree-of-Thought (ToT), as shown in their image below.



For example, in the Game of 24, GPT-4 with Chain-of-Thought prompting solved only 4% of tasks. In comparison, their ToT approach achieved a success rate of 74%.

The researchers remarked that CoT didn't perform as well as it "lacks mechanisms to try different clues, make changes to decisions, or backtrack."

And that's the main limitation of CoT. When considering a complex problem, humans (well, systematic and logical ones, at least) tend to explore a tree of thoughts, evaluating what works and what doesn't, backtracking if needed, and jumping back to a previous "node" in the tree if it was more beneficial or promising for the resolution of the problem.

## Example of Tree-of-Thought

The question many LLMs fail to address is the following. Let's consider the following prompt:

1. Bob is in the living room.
2. He walks to the kitchen, carrying a cup.
3. He puts a ball in the cup and carries the cup to the bedroom.
4. He turns the cup upside down, then walks to the garden.
5. He puts the cup down in the garden, then walks to the garage.
6. Where is the ball?

If you try the GPT-4.0 mini model, you might get the correct answer simply because Dave's work has become influential, and the authors of the LLM might have improved the model due to his work. Nevertheless, when I tried it, I got:

**"The ball is in the garden. When Bob put the cup upside down in the garden, the ball would have fallen out since the cup was no longer upright to hold it. If you have any further questions about this scenario or need clarification, feel free to ask!"**

This is the wrong answer since the cup went upside down in the bedroom, literally dropping the ball (and metaphorically in the case of the LLM).

Even if GPT-4.0 mini gets it right for you, try it with other models, and you'll be able to see the AI getting the answer wrong (usually, they will mistakenly reply that the ball is in the garden, in the cup, or spout a nonsensical answer.)

Now, let's create a new chat and place the following in the prompt instructions:

1. Imagine three different experts are answering this question.
2. All experts will write down 1 step of their thinking, then share it
3. with the group. Then all experts will go on to the next step, etc.
4. If any expert realizes they're wrong at any point, then they leave.
5. Answer the question based on experts' opinion. The question is...

In the prompt, plug in the same question as before:

1. He walks to the kitchen, carrying a cup.
2. He puts a ball in the cup and carries the cup to the bedroom.
3. He turns the cup upside down, then walks to the garden.
4. He puts the cup down in the garden, then walks to the garage.
5. Where is the ball?

Let's try the other two prompts suggested by Hulbert.

Open a new chat and use the same prompt, but this time, use the following for the Prompt Instructions:

1. Simulate three brilliant, logical experts collaboratively answering a question.
2. Each one verbosely explains their thought process in real-time, considering the prior explanations of others and openly acknowledging mistakes.
3. At each step, whenever possible, each expert refines and builds upon the thoughts of others, acknowledging their contributions.
4. They continue until there is a definitive answer to the question. The question is...

## Applying ToT to Something More Useful

Alright, enough with little riddles. Can we apply this prompt strategy to more practical and valuable approaches? We certainly can.

Imagine the following scenario: We just started a site selling shoes online. We want assistance from an LLM to produce a good marketing campaign, and we, of course, want to extract as many useful suggestions from the AI as possible.

A naive/standard prompt might be:

Define a marketing plan for my online store, which sells shoes.

Adopting the **Persona Pattern**, we have:

Acting as a marketing expert, define a marketing plan for my online store, which sells shoes.

Now, let's try the Tree-of-Thought Prompt Instructions like before:

1. Imagine three different experts are answering this question.
2. All experts will write down 1 step of their thinking,
3. then share it with the group.
4. Then all experts will go on to the next step, etc.
5. If any expert realizes they're wrong at any point, then they leave.

For the prompt, we can use our original question:

Define a marketing plan for my online store, which sells shoes.

### Expert Responses:

- Expert 1: The first step in defining a marketing plan is to identify your target audience. For an online shoe store, this could include demographics such as age, gender, and income.

## Next Steps & Additional Thoughts

- **Specificity in Instructions:** In a real-world scenario, while the generic steps are valuable, for more actionable results, you can be more specific in your instructions. For instance, you might request each "expert" to provide two actionable tactics or tools per step they suggest. And you can, of course, request specific experts or expertise.
- **Integration with Real Data:** If you can supply the LLM with specific data about your business (like target audience demographics, current website analytics, or specific marketing goals), it can potentially refine its responses even further. Just be mindful of potentially confidential information.
- **Segmented Inquiry:** Once you have a broad strategy laid out, you can dive deeper into each individual step, asking the experts to further expand on their suggestions or even query different experts about the same step to gather multiple perspectives.

## Exercises

1. Using the Tree-of-Thought prompting approach, leverage the LLM to answer a different type of question you might have.
2. Try to devise your variation of Dave's prompt instructions. Does it make the output better or worse? You might stumble upon a winning prompt that you can use in various scenarios.

## Key Considerations in Choosing Prompt Engineering Approach

In the current lecture, experts discuss key factors to consider when choosing a **prompt engineering approach** for generative AI. Here are the main points:

- **Task Objective:** Identify the specific task (e.g., text generation, summarization, code generation) you want to accomplish.
- **Model Capability:** Understand the strengths and limitations of the AI model you are using, as different models are suited for different tasks.
- **Clarity of Thought:** Clearly articulate your task in detail to avoid generic outputs or AI hallucinations.
- **Prompt Design:** Ensure prompts are clear, concise, and balanced between specificity and openness. Tailor prompts to leverage the model's strengths.
- **Data Requirements:** Consider how much context or background knowledge is necessary for the model to generate relevant responses.
- **Feedback Mechanism:** Use feedback to improve interactions with the model and enhance output quality.

## Module 3

### Text-to-Image Prompt Techniques

#### Introduction

Welcome to **Text-to-Image Prompt Techniques**. After watching this video, you'll be able to:

- ✓ Explain common image prompting techniques used to improve the quality and impact of images.
- ✓ Apply these techniques to write better prompts for image generation.

Images are an essential part of communication and are widely used in **marketing, advertising, education, journalism, and other fields**. Some images are more effective than others in conveying emotions and messages.

What is an Image Prompt?

An **image prompt** is a **text description** of the image you want to generate. It can be:

- A **single word** or phrase.

- A **detailed description** including **composition, colors, and mood**.

To improve the **quality, diversity, and relevance** of images produced by generative AI, we use **image prompting techniques**.

## Key Image Prompting Techniques

### 1. Style Modifiers

**Definition:** Style modifiers are descriptors that influence the **artistic style** or **visual attributes** of AI-generated images.

- ◆ **Modify visual elements** such as **color, contrast, texture, shape, and size**.
- ◆ Incorporate **art styles, historical periods, photography techniques, or well-known artists**.
- ◆ Help the AI **generate graphics that are aesthetically appealing**.

#### 💡 Example Usage:

- "A futuristic cityscape in the style of **cyberpunk** with neon lights and a rainy atmosphere."
- "A **watercolor painting** of a peaceful countryside during autumn."

### 2. Quality Boosters

**Definition:** Quality boosters are terms that enhance the **visual appeal, sharpness, and overall fidelity** of the output.

- ◆ Improve **resolution and clarity**.
- ◆ Reduce **blurriness, pixelation, and noise**.
- ◆ Enhance **sharpness, color correction, and detail visibility**.

#### 💡 Common Terms:

- ✓ High resolution, 2K, 4K
- ✓ Hyper-detailed, sharp focus
- ✓ Vibrant colors, blurred background

#### 💡 Example Usage:

- "A highly detailed **4K resolution** image of a snow-covered mountain with **sharp, crisp details**."

### 3. Repetition

**Definition:** This technique emphasizes a specific **visual element** by repeating key terms in the prompt.



- ◆ Helps AI **focus on a specific idea**.
- ◆ Improves **consistency and memorability**.
- ◆ Generates **multiple variations** of an image based on subtle differences.

#### 💡 Example Usage:

- "A vast, endless desert under a serene, clear sky with tiny, scattered cacti."

## 4. Weighted Terms

**Definition:** Weighted terms **increase or decrease** the emphasis on certain words in the prompt to **control emotional or psychological impact**.

- ◆ Assign **positive or negative weights** to words for better AI focus.
- ◆ Create **memorable, convincing, and emotionally engaging images**.

#### 💡 Example Usage:

- "A warm (+10) and crackling (+8) fireplace in a cozy cabin."
- "An exotic (+10) tropical island with colorful (-6) scenery."

## 5. Fix Deformed Generations

**Definition:** This technique corrects **distortions and anomalies** in AI-generated images, such as:

- ◆ **Body part distortions** (e.g., extra fingers, unnatural limbs).
- ◆ **Pixelation or unnatural details**.
- ◆ **Unrealistic proportions and structures**.

💡 **Solution:** Use **negative prompts** to **avoid unwanted distortions** in AI-generated images.

#### 💡 Example Usage:

- "A realistic portrait of a smiling woman, **hands correctly drawn, no distortions, no extra fingers.**"

## Conclusion

By incorporating these **five essential techniques**, you can create **high-quality, engaging, and persuasive** images that effectively communicate your message.

### Summary of Techniques:

- ✓ **Style Modifiers** – Control artistic styles and visual attributes.
- ✓ **Quality Boosters** – Enhance resolution, clarity, and sharpness.
- ✓ **Repetition** – Reinforce key visual elements for better focus.
- ✓ **Weighted Terms** – Adjust emotional impact by assigning term weights.
- ✓ **Fix Deformed Generations** – Correct distortions using negative prompts.

# Final Project: Applying Prompt Engineering Techniques and Best Practices

## Exercise 1: Drafting Clear and Precise Prompts

### Objective

In this exercise, we will experiment with prompts to understand how applying best practices for drafting clear and precise prompts can improve the output.

### Scenario

Consider the following prompt created by a **computer science student** who is exploring career options:

#### Initial

#### Prompt:

"Please guide me on potential career paths in the field of computer science, considering my interests, skills, the evolving technology landscape, and the impact of AI, while also factoring in work-life balance and opportunities for personal growth."

### Analysis of the Initial Prompt

This prompt is **ambiguous and overly complex** because:

- It covers too many aspects simultaneously (career paths, technology trends, AI impact, work-life balance, and personal growth).
- It lacks specific details about the student's **interests, skills, or goals**, making it difficult to provide tailored advice.

## Task

### Your Role

Assume you are this student. Your task is to **design clear and precise prompts** by making necessary assumptions about your interests, skills, or career goals.

### Instructions

1. **Create a new chat.** Name it appropriately based on the context.
2. **Enter the following text in the "Prompt Instructions" field:**

"I am pursuing graduation in computer science and exploring career opportunities for me after completing my degree."

## Refined Prompts for Clarity

Prompt 1: Career Paths Based on Interests

**"I have a strong interest in machine learning and natural language processing. How can I leverage these interests and my programming skills in a career?"**

Prompt 2: AI-Focused Career Preparation

**"With AI becoming increasingly important, how can I prepare for a career that is AI-focused?"**

Prompt 3: Work-Life Balance Considerations

**"I value work-life balance and flexible work arrangements. What career paths can provide me with these benefits?"**

Prompt 4: Leadership and Career Advancement

**"In the long term, I aspire to take on leadership roles. What career steps should I consider to advance into leadership positions in the IT or tech industry?"**

## Key Takeaways

- **Be Specific:** Clearly define your interests, skills, or goals in the prompt.
- **Break Down Complex Queries:** Instead of merging multiple questions, create separate, focused prompts.
- **Consider Context:** Ensure the prompt provides sufficient details to generate useful and personalized responses.

## Exercise 2: Experimenting with the Tree-of-Thought Approach

Task:

In this exercise, let's apply the ideas of Dave Hulbert to devise a marketing strategy for the launch of a new product—a high-end smartphone—using the Tree-of-Thought approach.

Activities:

### *1. Create a New Chat*

- Name the chat based on the context.

### *2. Provide Tree-of-Thought Instructions*

Enter the following instructions in the Prompt Instructions field:

1. Imagine three different experts answering this question.
2. All experts will write down one step of their thinking and then share it with the group.
3. Then, all experts will go on to the next step, etc.
4. If any expert realizes they're wrong at any point, they leave.

### ***3. Provide a Naïve Prompt***

Ask the model to generate a marketing strategy for the high-end smartphone launch.

Example Prompt:

"Provide a marketing strategy for our new product launch—a high-end smartphone."

### ***4. Enhance the Prompt for Clarity and Precision***

You have learned best practices for writing effective prompts with clarity, context, and precision. Now, design a follow-up question that provides specific tactics for the marketing strategy.

Example Prompt:

"For each expert, please provide two actionable tactics per step that you suggested."

### ***5. Guide the Model with Specific Data***

You can input specific data to help the generative model produce detailed and relevant responses. Provide marketing goals to refine the tactics.

Example Prompt:

"Our primary goal is to establish this product as a premium choice in the smartphone market, drive consumer excitement, and achieve significant market share. We want to focus on both online and offline channels to maximize our reach. For each expert, modify or refine the tactics you provided in consideration of these marketing goals."

### ***6. Refine Responses Further***

Once a broad strategy is laid out, refine the response by diving deeper into individual steps. Ask specific experts for detailed insights.

Example Prompt:

"For Expert 1—Regarding Step 1, could you please provide more specific details on the types of market research surveys you would conduct to gather demographic information? What are some key demographic parameters you'd focus on to define the target audience?"

## Exercise 3: Experimenting with the Interview Pattern Approach

Task:

The interview pattern approach to prompt engineering involves designing prompts that simulate a conversation or interact with the model in an interview style. In this exercise, you will experiment with this approach.

Activities:

### ***1. Create a New Chat***

- Name the chat based on the context.

### ***2. Provide the Initial Prompt***

Start the conversation by asking about the impact of generative AI on various industries.

Example Prompt:

"Can you share your insights on the impact of generative AI on various industries?"

### ***3. Refine the Output for Specific Industries***

Generate more details and examples about generative AI applications in a particular industry, such as healthcare.

Example Prompt:

"How is generative AI being utilized in the healthcare industry? Are there any specific examples of applications that have made a significant difference?"

### ***4. Consider Ethical Considerations***

Think about additional aspects for a blog on generative AI in healthcare. Since ethical considerations are crucial in AI, request guidance on challenges and ethical concerns.

Example Prompt:

"What are the challenges and ethical considerations related to generative AI in healthcare?"