

2025



## **Lesson 04**

# **Prompt Engineering**

# Introduction

- Prompt engineering is the process of designing and refining text inputs (prompts) to effectively interact with AI models like OpenAI ChatGPT.
- Its core purpose is to generate desired and relevant outputs.
- It combines creativity, logic and an understanding of AI behavior to bridge human intentions with machine-generated response.
- Key features are:
  - Interactive Communication: Enables meaningful and task-specific conversations with AI models.
  - Thoughtful Prompt Design: Crafting specific instructions to reduce ambiguity.
  - Iterative Design: Often involves testing and improving prompts to optimize results.
  - Versatile Application: Applicable in diverse areas such as writing, coding, decision support, and automation.

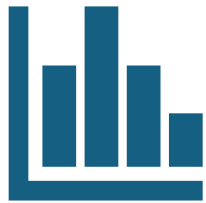
# Why Prompt Engineering Is Important?

- AI is becoming integral in industries like education, healthcare, marketing, and more.
- Prompt engineering skills enable individuals to maximize AI's utility.
- Poorly crafted prompts yield irrelevant or inaccurate results.
- Prompt engineering is a key competency in the AI-driven job market.
- Empowers individuals to design solutions without extensive programming knowledge.
- As AI systems evolve, prompt engineering ensures you stay ahead in understanding and utilizing these technologies effectively.

# Understanding Generative AI



# Brief Overview of How it Works



Training Data



Learning Process

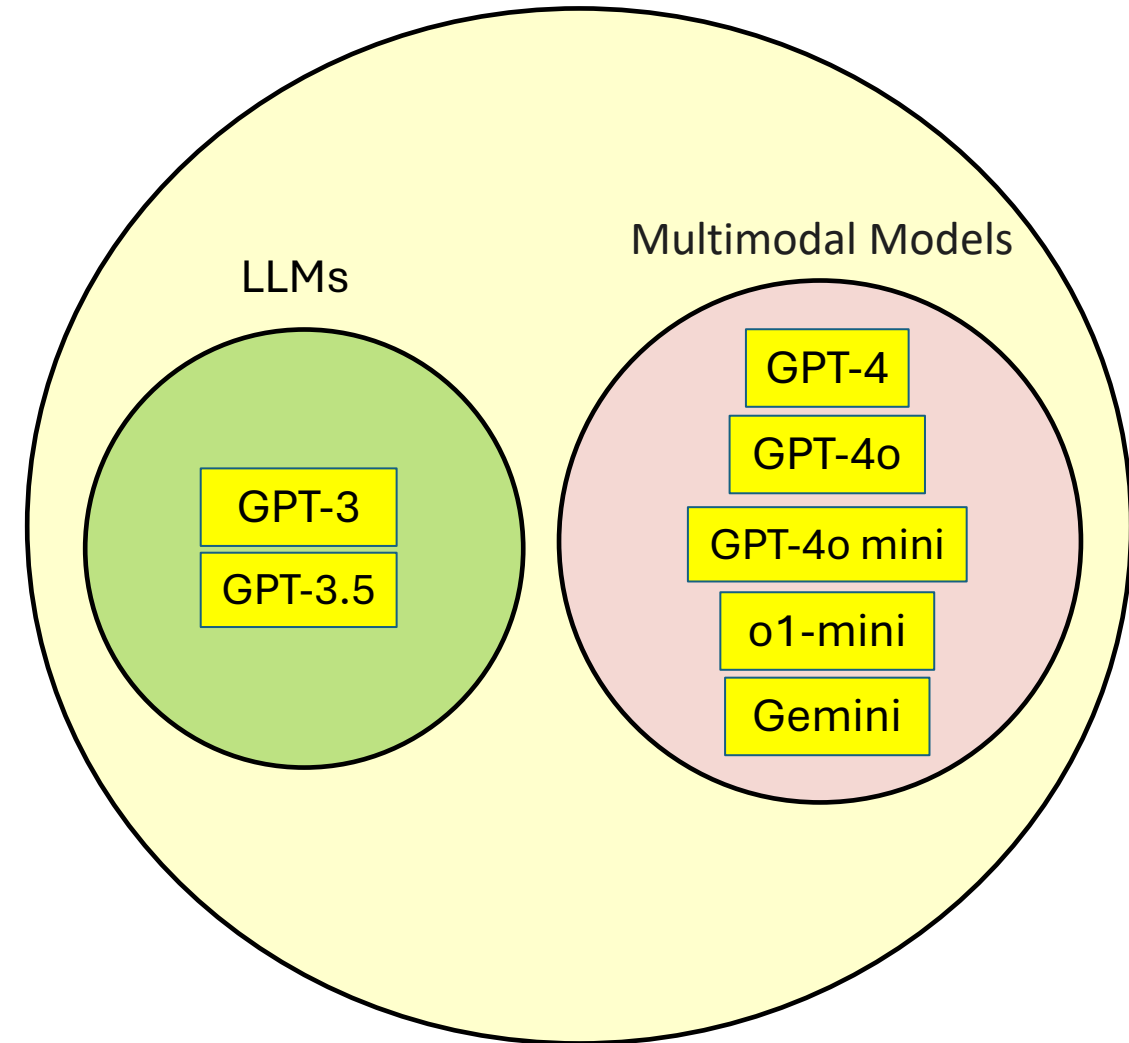


Data Generation

# Large Language Models (LLMs) vs Multimodal Models

Aspect	LLMs	Multimodal Models
Data Type	Primarily text-based	Multiple types (text, images, audio, video)
Focus	Understanding and generating text	Integrating and understanding multiple data types
Applications & Example Tasks	Translation, summarization, text completion, sentiment analysis	Image captioning, visual question answering, speech recognition, object detection in images
Integration with Other Modalities	Generally not designed to handle non-text data	Specifically designed to handle and integrate various data types

Generative AI Models



# How do LLMs work?

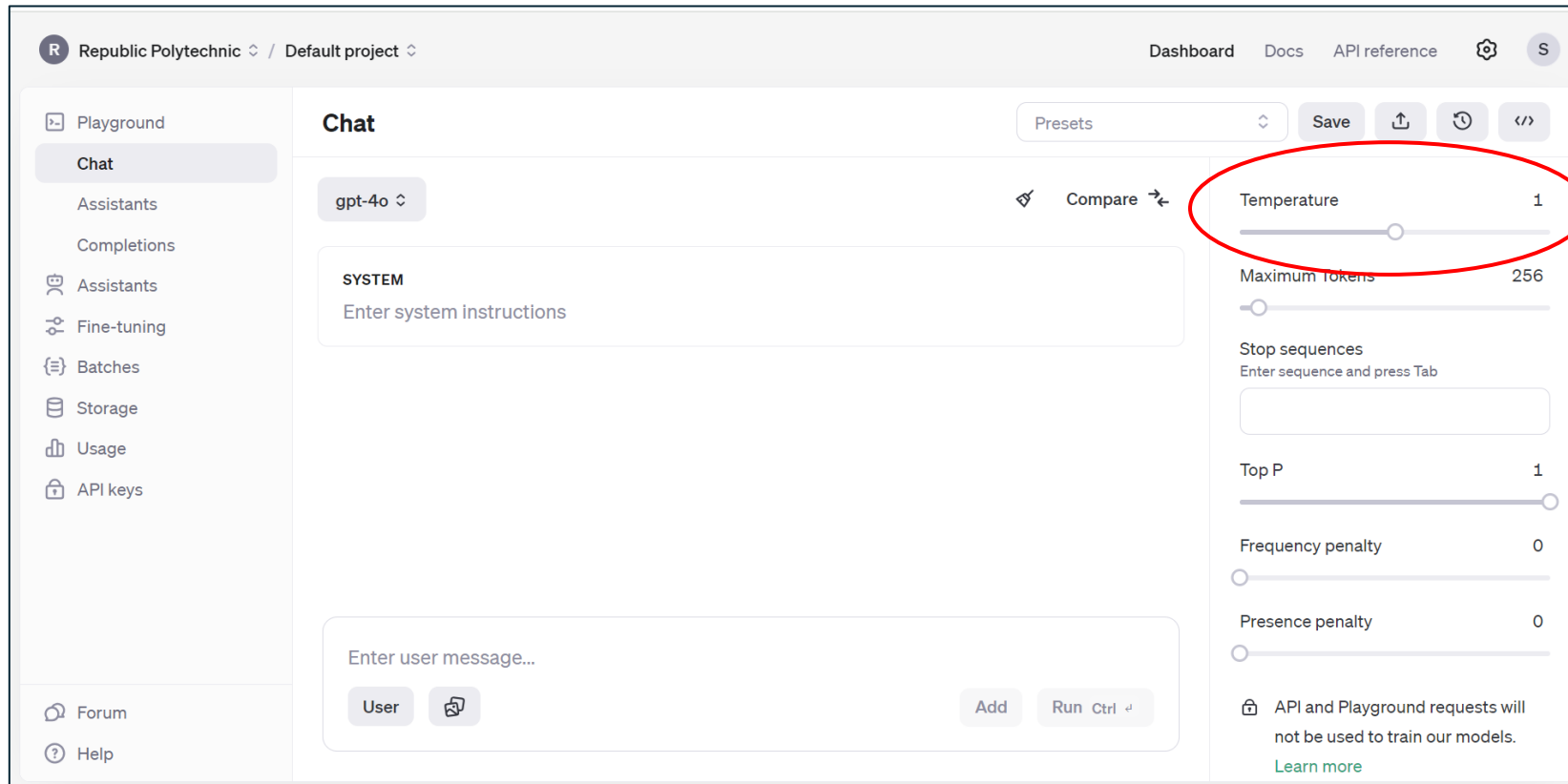


Roses are red, \_\_\_\_\_

No man is \_\_\_\_\_

Note: There are randomness in the output!

# Randomness in LLMs (OpenAI ChatGPT)



Temperature controls the creativity or randomness of the output text.

A higher temperature results in more creative and surprising output while a lower temperature results in more conservative and deterministic output.

“**Temperature**” is the standard terminology used.

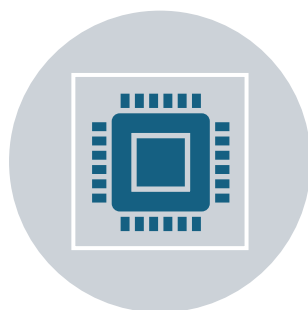
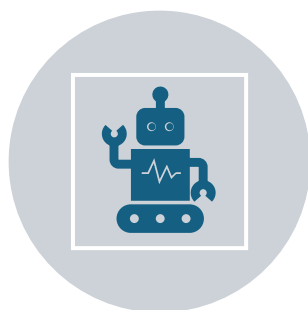
<https://platform.openai.com/playground> (paid)

Alternatively you can try this → <https://console.groq.com/playground>



# Applications of Generative AI

- Text generation: AI-written articles, automatic report generation, dialogue systems, etc.
- Image generation: Art creation, deepfake videos, designing 3D objects, etc.
- Speech synthesis: Virtual assistants, audio book narration, etc.
- Other applications like music composition, data augmentation, coding etc.



# What is a Prompt in AI?

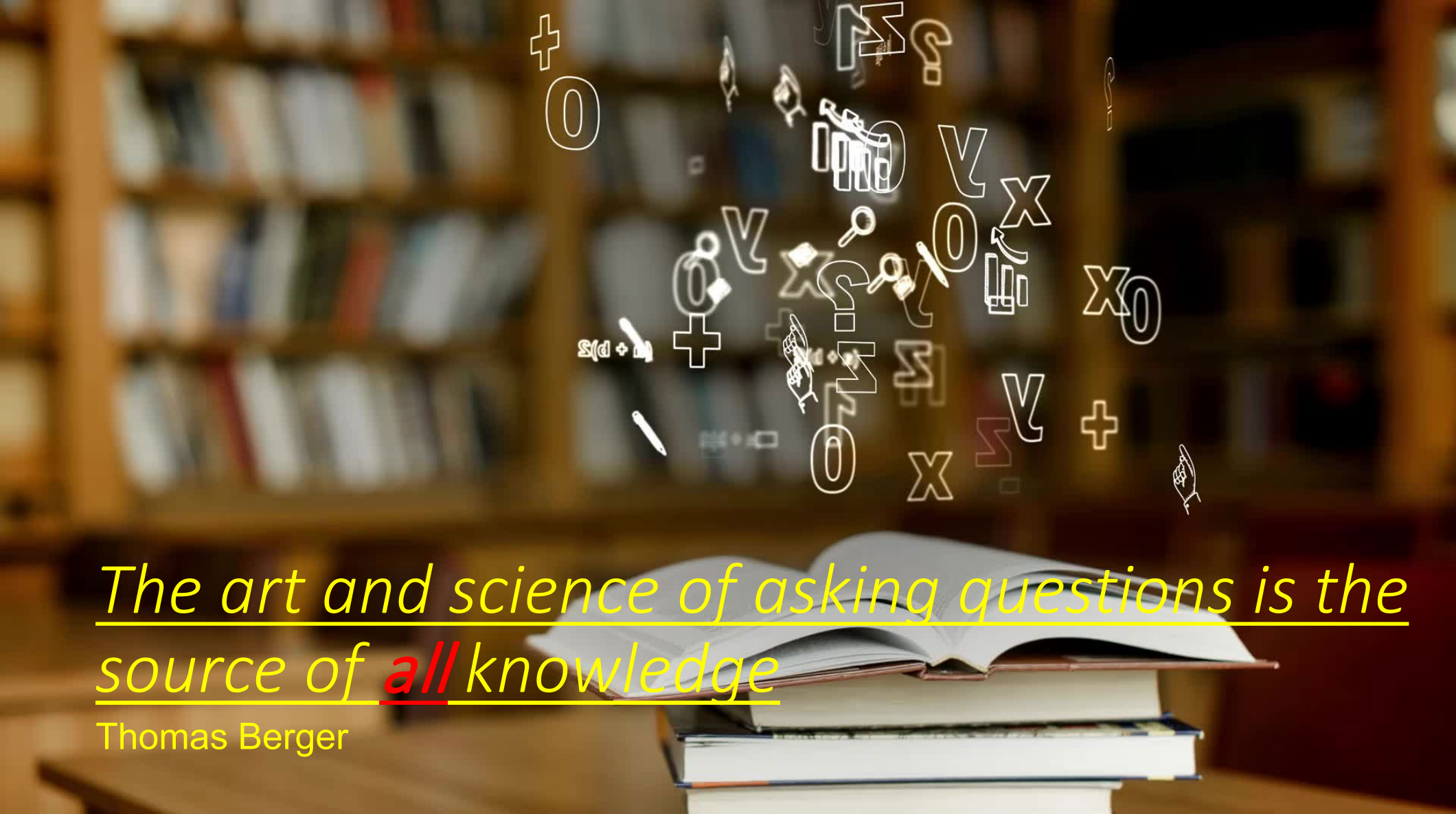
- A statement or question that invokes a response from the AI model.
- The starting point for AI's generative process.
- The seed that grows into the output that the AI model generates.



# The Role Of Prompts in AI

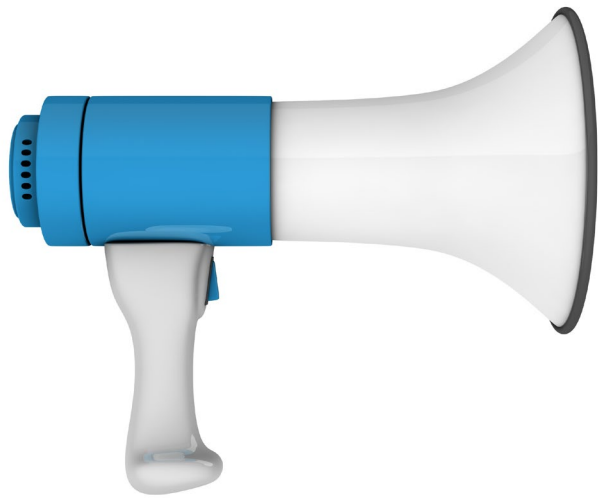


- Determine tasks
- Set boundaries
- Establish context/subject
- For example, **write a short poem about the ocean.**
  - What is the task? (write a poem)
  - What is the boundary? (length must be short)
  - What is the context/subject? (about the ocean)



*The art and science of asking questions is the  
source of **all** knowledge*

Thomas Berger



# Before we continue further ...

# OpenAI will use the data you provided unless you disable it

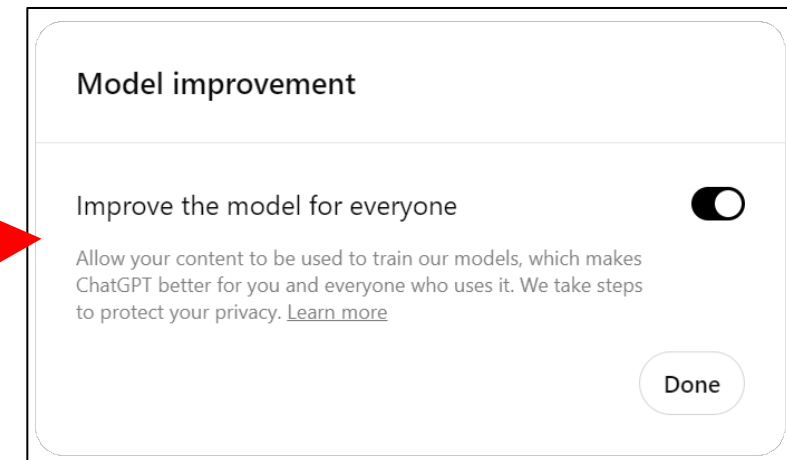
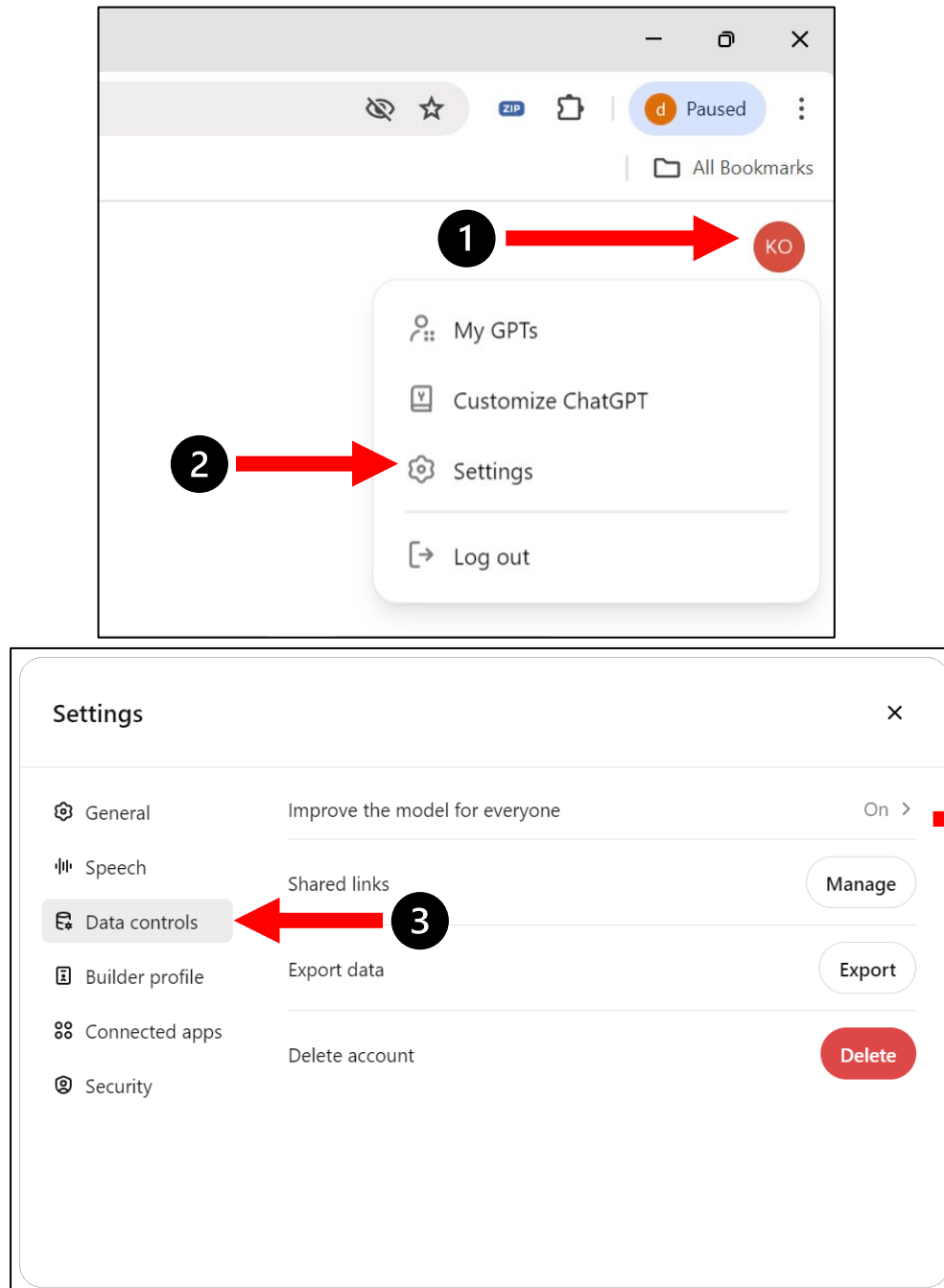
## ChatGPT

When you use our non-API consumer services ChatGPT or DALL-E, we may use the data you provide us to improve our models. You can switch off training in ChatGPT settings (under Data Controls) to turn off training for any conversations created while training is disabled or you can submit [this form](#). Once you opt out, new conversations will not be used to train our models.

Source: <https://help.openai.com/en/articles/5722486-how-your-data-is-used-to-improve-model-performance>



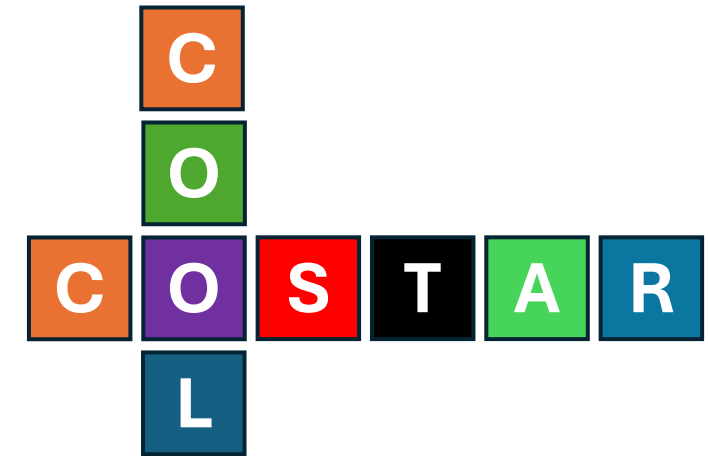
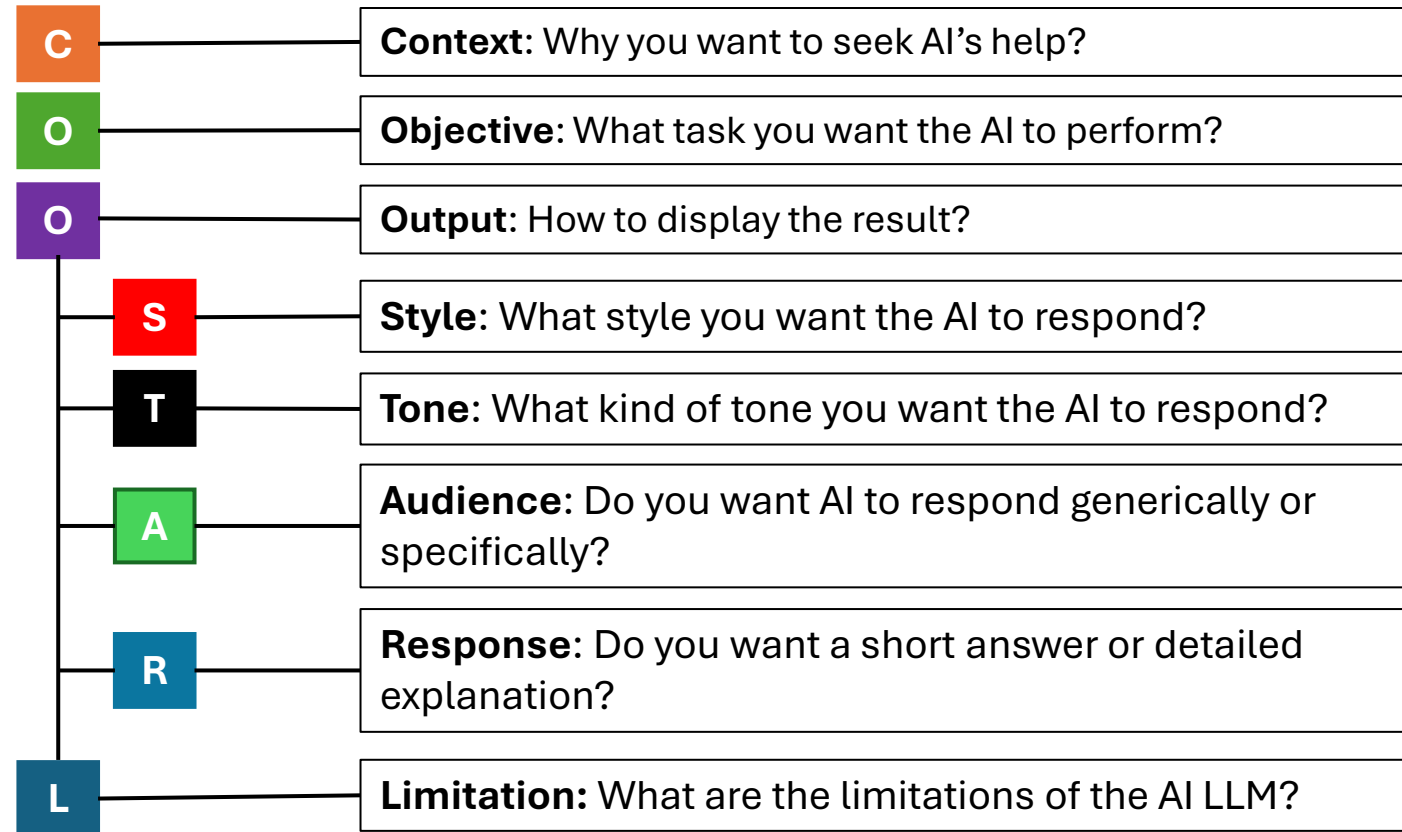
If you don't want  
OpenAI to use your  
data to improve their  
models



Switch off to

- Disable saving new chat on this browser to your history and
- Disallow them to be used to improve OpenAI's models.

# Factors of Effective Prompts – COOL-STAR Principles



\*LLM: Large Language Model



# Focus on COO for Now

- Sufficient **Context**: (Why)
  - **Why** do you want to seek AI's help?
  - Provide the relevant background/subject information and focus of the writing.
- Clear **Objective**: (What)
  - **What** task do you want the AI to do? (e.g., write an article, craft a story)
  - **What** question do you want the AI to answer?
- Specific **Output**: (How)
  - **How** to display the result?
  - The format, style, tone, and length?

# STAR – Relating to Output

- **S-Style**
  - The style you want the response to be in. For example, generic response or a particular person's style of writing.
- **T-Tone**
  - Do you want the response to be causal, professional or humorous so that it resonates better with the audience.
- **A-Audience**
  - Are you writing to a general audience or specific group?
- **R-Response**
  - Text, numbered form or tabular form?

# Sample Prompt

I am a lecturer that teaches blockchain. I want to test my second-year polytechnic students' understanding of the following topics:

- Blockchain Structure
- Smart Contracts

Create 3 multiple choice questions for me.

For each question, provide the correct answer. Then write feedback to students about the correct and incorrect options.

# Breakdown of the Components

I am a lecturer that teaches blockchain. I want to test my second-year polytechnic students' understanding of the following topics:

- Blockchain Structure
- Smart Contracts

Create 3 multiple choice questions for me.

For each question, provide the correct answer. Then write feedback to students about the correct and incorrect options.

Sufficient **Context**

Clear **Objective**

Specific **Output**

# Crafting Effective Prompts - Practical Tips

- Engage the Model
  - **Not Engaging**: “List all the countries in the world.”
  - **Not Engaging**: “What's 1 + 1?”
  - **Engaging**: “Create Python code to retrieve the pricing info from XYZ website.”
- Be Conversational<sup>1, 2</sup>
  - Good example: “Hey ChatGPT, can you help me understand how blockchain technology can improve supply chain management? Feel free to include examples.”
  - Bad example: “Blockchain. Supply chain.”
- Experiment and iterate

1. [Hard Evidence That Please And Thank You In Prompt Engineering Counts When Using Generative AI](#)
2. [Does Being Nice to ChatGPT Make It Work Better? We Tested It Out.](#)

# Understanding of AI's



Source: <https://www.picpedia.org/highway-signs/l/limitation.html>

# Model Limitations

- Data bias
- Lack of contextual understanding
- Lack of memory
- Lack of common sense
- Ethics and safety concerns
- Limited ability to learn
  - GPT-3.5: Up to Sep 2021
  - GPT-4: Up to Apr 2023
  - Gemini: Early 2023
  - Claude 3.5 Sonnet: Apr 2024
- Inability to verify information



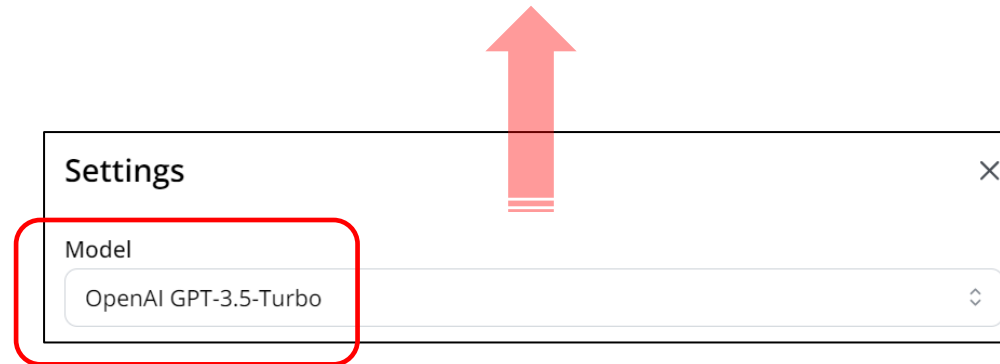
# Lack of Common Sense



The trophy doesn't fit into the brown suitcase because it's too small. What is too small?



In the given sentence, "it's too small" refers to the trophy. The sentence means that the trophy is too small to fit into the brown suitcase.



\*Latest LLM models reduce the effect significantly



# Limited Ability to Learn (Pre-trained model)

Example 1:

“Make up a plausible sounding scientific theory that hasn’t been discovered yet.” vs.  
“Explain the theory of relativity.”

Example 2:

“Tell me what I’m thinking.” vs. “Tell me about cognitive processes involved in thinking.”

1. A Large language model (LLM), has a limited ability to "learn" in the traditional sense because it is designed to work based on patterns and information it has been exposed to during its training.
2. LLMs rely on learned knowledge, so they can explain known theories but cannot "learn" new concepts in real time or invent them.

# Hallucination of LLM

- A phenomenon where the LLM generates text that is incorrect, nonsensical, or not real

Reason for Hallucination	Ways to Reduce Hallucination
Training data bias and noise	Careful selection and cleaning
Lack of specificity in prompting	More specific and clear prompts; Reducing the "temperature"
No access to external, real-world knowledge	Testing against ground truth; Injecting specific context to the prompt

# Four Types of Tasks/Objectives



## Transformation

- Translating
- Correcting
- Reformatting
- Refactoring
- ...



## Reduction

- Extracting
- Summarising
- Distilling
- Condensing
- Abstracting
- ...



## Generation

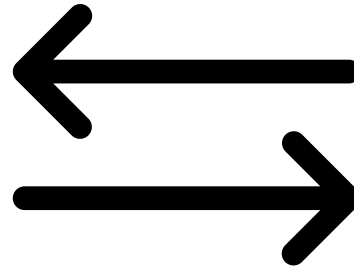
- Drafting
- Planning
- Brainstorming
- Expanding
- ...



## Analysis

- Classifying
- Clustering
- Evaluating
- ...

# Transformation



# Transformation

- Create **fresh text** that mirrors the content of the existing one, but with different expressions.
- Objective:
  - To maintain the **meaning** of the original text
  - While presenting it in **a new form**.

# Correction

Prompt: Correct the grammatical errors: “I go to school this morning but forget to wear my shoe.”

Response: “I went to school this morning but forgot to wear my shoes.”

# Paraphrasing

Prompt: Paraphrase the following sentence: “The early bird catches the worm.”

Response: “Those who arrive first have the best opportunities.”

# Simplifying

Prompt: Simplify the following text: “In an environment where resources are limited, prioritizing tasks becomes an essential component of efficient management.”

Response: “When resources are low, putting tasks in order is key to managing well.”



# Translating to Another Language

Prompt: Translate the following English text into Chinese: “The cat is on the roof.”

Response: “这只猫在屋顶上。”

# Changing Tone or Style

Prompt: Rewrite the following formal text in an informal style:

“It is of utmost importance that you arrive punctually at the meeting.”

Response: “Make sure you’re on time for the meeting. It’s really important.”

# Adapting to a Specific Audience

Prompt: Rewrite the following scientific statement for a child:

“The water cycle describes the continuous movement of water on, in, and above the Earth.”

Response: “The water cycle is like a big loop where water moves around the Earth, going up into the sky and back down again.”

# Reduction - Extracting

# Extracting

- Pinpoint and draw out certain **details** or **pieces of data** from a more extensive document.



# Keyword Extraction

Prompt: Extract the top 3 key topics from the following text:

Climate change, largely driven by human activities like deforestation and fossil fuel burning, is a global crisis requiring immediate action. The planet is experiencing severe weather events, rising sea levels, and disrupted ecosystems. This not only threatens natural habitats but also poses risks to human communities, such as food and water scarcity and increased disease prevalence. Swift and collective efforts are needed to mitigate these changes and safeguard the planet for future generations.

Response:

1. Climate change
2. Human activities (Deforestation and Fossil fuel burning)
3. Global crisis requiring immediate action

# Named Entity Recognition (NER)

Prompt: Identify the names of people, organizations, and locations in the following text:

John Doe is an employee at Google, where he works at the company's headquarters located in Mountain View, California. He serves as a Software Engineer in the Research and Development department, where he focuses on machine learning algorithms designed to improve search engine efficiency. John is part of a diverse and talented team, collaborating with experts from around the world to create innovative solutions. His work involves a mix of coding, data analysis, and strategic planning, allowing him to utilize his skills in both technology and critical thinking.

Response:

People: John Doe;

Organizations: Google;

Locations: Mountain View

## **Extracting Specific Details (e.g., Dates, Numbers)**

Prompt: Extract the dates mentioned in the following text:

We are excited to announce the upcoming annual industry conference that many have been eagerly anticipating. The conference will be held from June 12 to June 14, 2023. This year's theme is "Innovating for the Future", which aims to explore groundbreaking approaches and technologies in our field.

Response: "June 12 to June 14, 2023"



# Extracting Information for a Particular Purpose

Prompt: Extract the list of ingredients from the following recipe:

For a quick and delicious spaghetti Aglio e Olio, start by boiling 400 grams of spaghetti in salted water until al dente. While the pasta cooks, heat 1/4 cup of olive oil in a large skillet over medium heat and add 4 minced garlic cloves and a pinch of red pepper flakes, sautéing until the garlic turns golden. Drain the pasta, reserving about 1 cup of pasta water. Add the spaghetti to the skillet, tossing it in the garlic oil to coat. Gradually add the reserved pasta water to achieve your desired sauce consistency. Finish by mixing in a handful of chopped fresh parsley and a generous sprinkle of grated Parmesan cheese. Serve immediately for a simple yet satisfying meal.

Response:

400 grams of spaghetti, Salted water, 1/4 cup of olive oil, 4 minced garlic cloves, Pinch of red pepper flakes, 1 cup of reserved pasta water (optional, for sauce consistency), Handful of chopped fresh parsley and Grated Parmesan cheese

# Reduction - Summarising

# Summarising

Condense a lengthy text into a **more manageable** and **concise summary** that encompasses the essential thoughts and concepts



# General Summary

Prompt : Summarize the following text:

Climate change, largely driven by human activities like deforestation and fossil fuel burning, is a global crisis requiring immediate action. The planet is experiencing severe weather events, rising sea levels, and disrupted ecosystems. This not only threatens natural habitats but also poses risks to human communities, such as food and water scarcity and increased disease prevalence. Swift and collective efforts are needed to mitigate these changes and safeguard the planet for future generations.

Response: “Climate change is an urgent crisis caused by human activity, leading to extreme weather and threats to ecosystems and communities.”

# Abstract Summary (Highlighting Key Concepts and Theories)

Prompt: Abstract the key concepts from the following scientific text:

Quantum mechanics is a groundbreaking theory in physics that delves into the behavior of matter and energy at extremely small scales—atomic and subatomic levels. Unlike classical physics, which falls short in explaining phenomena at these scales, quantum mechanics introduces counterintuitive principles like superposition and entanglement. Superposition allows particles to exist in multiple states simultaneously, defying our everyday understanding of reality. Entanglement describes a peculiar connection between particles, where the state of one instantly influences the state of another, regardless of the distance separating them. These principles challenge traditional physics and open new avenues for technological advancements.

Response: “The text discusses quantum mechanics, focusing on behaviors at atomic levels, and introduces principles like superposition and entanglement.”

# Executive Summary (Business Context)

Prompt: Write an executive summary of the following business report:

Last quarter, our company saw a robust 15% increase in sales, highlighting the strength of our current business model. To sustain this positive trend, we propose a strategic expansion into new markets. Preliminary research suggests these untapped regions are highly compatible with our product offerings. By diversifying our revenue streams and enlarging our customer base, we aim to solidify our market presence and ensure long-term growth. This initiative will necessitate thorough planning but promises significant returns, warranting immediate action.

Response: “The company observed a 15% sales increase last quarter. To sustain this growth, the recommendation is to explore new markets.”

# Narrative Summary (Story Context)

Prompt: Summarize the following story:

In the beginning, John felt like a fish out of water in the small town. The tight-knit community seemed impenetrable, and he often ate lunch alone. Determined to break the cycle, he decided to participate in local events and even joined a weekend hiking group. Gradually, the town's folks began to warm up to him. Mrs. Thompson, the local baker, started setting aside her famous blueberry muffins just for him, and he even joined a local softball league. Slowly but surely, John found himself woven into the fabric of the community, forming friendships that made his life richer and his heart lighter.

Response: “John’s move to a small town led to initial struggles, but he ultimately made friends and became content in his new surroundings.”

# Bullet-Point Summary (Structured Information Extraction)

Prompt: Summarize the following text into bullet points:

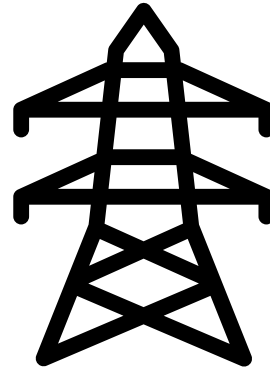
Apple Inc., founded in April 1976 by Steve Jobs, Steve Wozniak, and Ronald Wayne, revolutionized personal computing with the introduction of the Apple I and later the Apple II. Based in Cupertino, California, the company shifted paradigms in the tech world with products like the iPod, iPhone, and iPad. The introduction of the iOS App Store created a new ecosystem for mobile software. Apple also made strides in software, notably with its macOS and iOS operating systems. Its online services, such as iCloud and Apple Music, further diversify its revenue streams. Known for innovation and high-quality design, Apple has become a global leader in technology.

Response:

Apple Inc. was founded in April 1976 by Steve Jobs, Steve Wozniak, and Ronald Wayne.  
Revolutionized personal computing through the introduction of Apple I and Apple II.  
Based in Cupertino, California.  
Introduced game-changing products like iPod, iPhone, and iPad.



# Generation



# Generating

- Create new text from a given prompt or context.
- Useful in various applications like emails, speeches, or marketing materials.
- Can be applied creatively to write poems, tell jokes, or compose stories.
- May reveal the issue of hallucination where output might be ungrounded.

# Structured Text Generation

Prompt: “Generate a recipe for chocolate chip cookies including ingredients and steps.”

Response:

- Ingredients:
  - 1 cup butter, 2 cups flour, 1 cup sugar, chocolate chips...
- Steps:
  - 1. Preheat oven to 350°F.
  - 2. Mix butter and sugar.
  - 3. Add flour and chocolate chips

# Question and Answer Generation

Prompt: “Create a Q&A about the solar system.”

Response:

Q: What is the largest planet in the solar system?

A: Jupiter.

Q: How many planets are there in the solar system?

A: There are eight planets.

# **Creative Writing (Poems, Songs, etc.)**

Prompt: “Write a haiku about a tranquil forest.”

Response:

Forest whispers calm,  
Leaves rustling with gentle breeze,  
Nature’s peace embraced.

# Business Communication Generation

Prompt: “Compose an email to inform employees about an upcoming team-building event.”

Response:

Dear Team, I am excited to announce an upcoming team-building event scheduled for next Friday. This is a great opportunity to connect and grow...

# Ideation and Brainstorming

Prompt: “Generate five innovative ideas for reducing plastic waste in the community.”

Response:

1. Community Refill Stations: .....
2. Plastic-Free Events: ....
3. Plastic Waste Art Projects: ....
4. Local Plastic Ban or Reduction Initiatives: ....
5. Plastic Exchange Programs ....

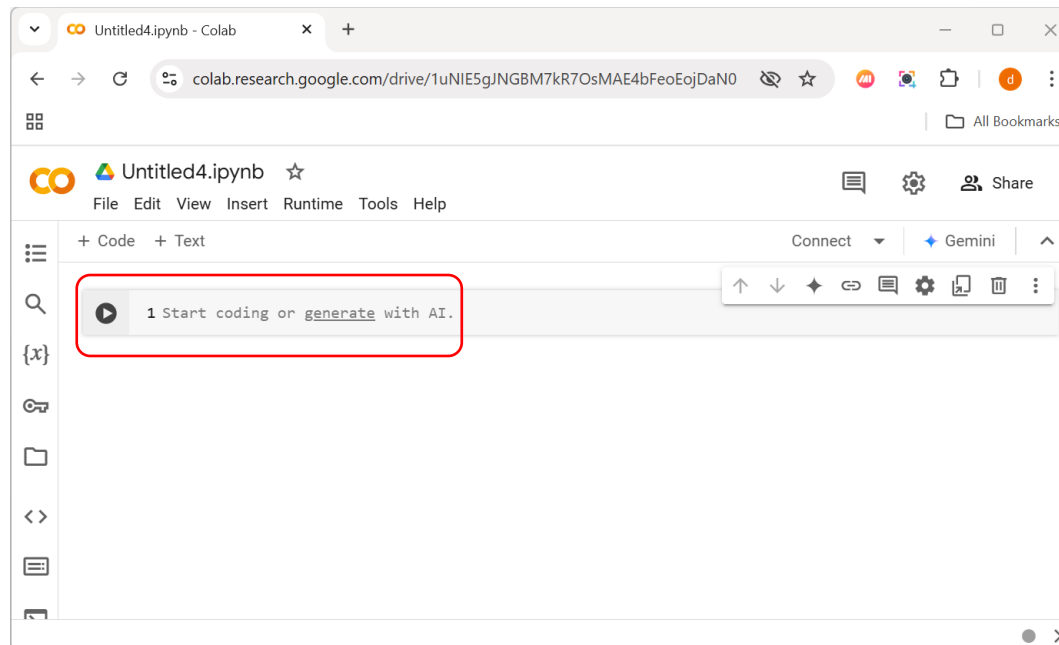
# Code Generation

Prompt: “Write a Python function that takes two numbers as input and returns their sum.”

Response:

```
python Copy code  
  
def add_numbers(a, b):  
    return a + b
```

Example:





# Analysis - Classifying



# Classifying

- Assign text to categories or labels, like sentiments or types of problems.
- Assist in making decisions and supporting analytical tasks
- May need to create specific labels

# **Sentiment Analysis (Positive/Negative/Neutral)**

Prompt: Classify the sentiment of the following review:  
“The service was fantastic, but the food was mediocre.”

Response: “Mixed sentiment”

# Topic Categorization

Prompt: Classify the following text into one of these categories: **Technology**, **Health**, **Finance**. “Recent advancements in AI are revolutionizing the tech industry.”

Response: “Technology”

# Spam Detection

Prompt: Is the following email spam or not? “Congratulations! You’ve won a free vacation! Click here to claim your prize!”

Response: “Spam”

# Language Identification

Prompt: Identify the language of the following text: “C’est la vie.”

Response: “French”

# Age Appropriateness

Prompt: Classify the following content as suitable for Children, Teens, or Adults: “A comprehensive analysis of the psychological impacts of workplace stress and methods for coping.”

Response: “Adults”

# Urgency Level

Prompt: Classify the urgency of the following customer support ticket: “My product arrived damaged, and I need a replacement as soon as possible!”

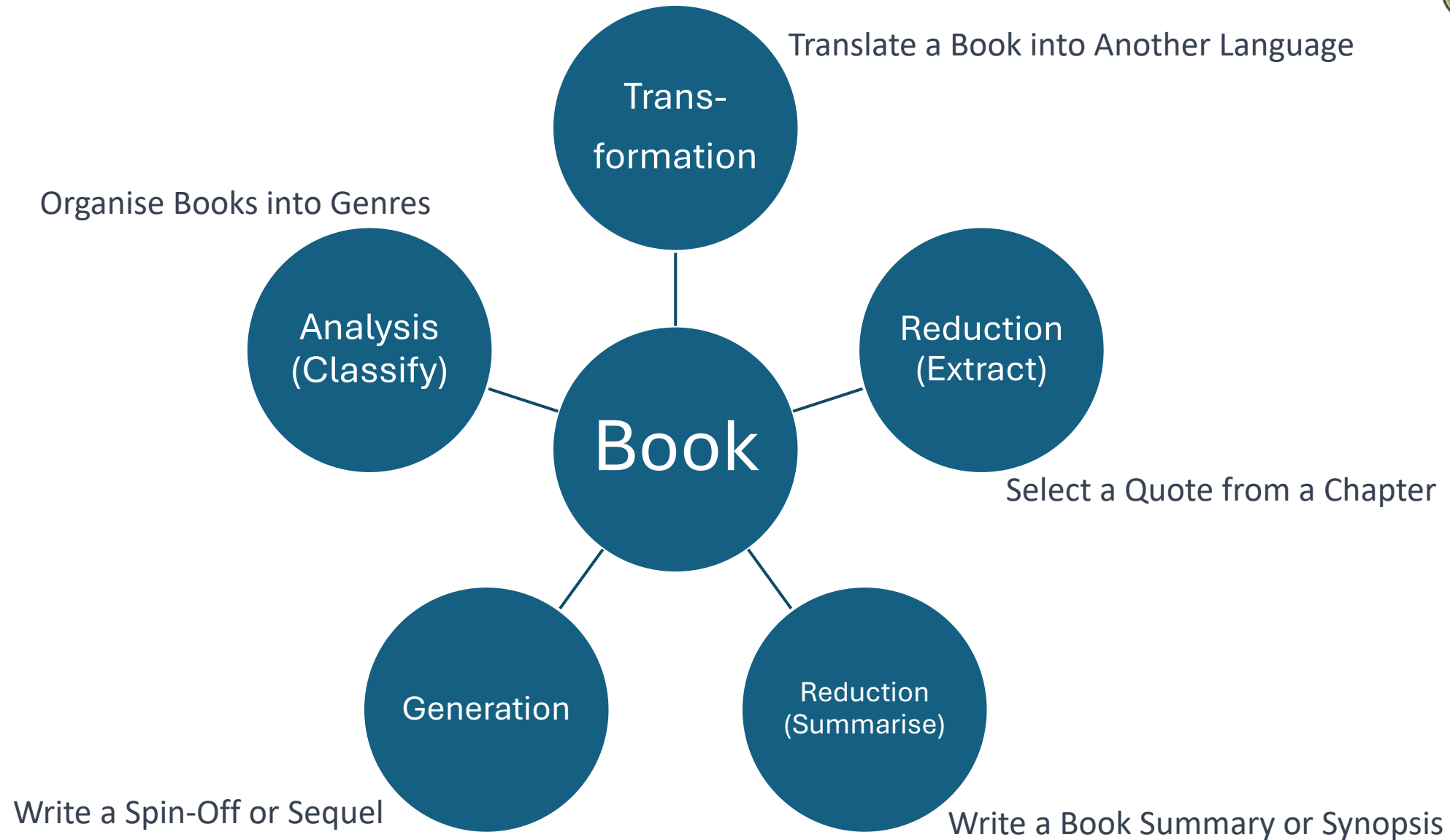
Response: “High Urgency”



# Customer Feedback (Product/Service Experience)

Prompt: Classify the following feedback as a compliment, complaint, or suggestion: “The new software update has a very intuitive design. Great job!”

Response: “Compliment”



# Summary

- Prompt engineering is the practice of crafting effective inputs (prompts) to interact with AI models like GPT for desired outputs. After learning the basics of prompting, students understand that the structure, clarity, and specificity of prompts significantly influence the model's performance.
- AI models rely on the instructions provided in prompts to generate responses. Clear and context-rich prompts lead to better results.
- Vague prompts lead to irrelevant or suboptimal outputs. Specificity is key.
- Prompt creation is an iterative process. Adjusting and experimenting with phrasing helps achieve optimal response.

# References

- Prompt Engineering

<https://platform.openai.com/docs/guides/prompt-engineering>

- Gemini for Google Workspace – Prompt Guide

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- ChatGPT Prompt Engineering

<https://www.promptingguide.ai/models/chatgpt>

- A Beginner's Guide to ChatGPT Prompt Engineering

[DataCamp](#)

- Prompt Engineering Playbook

<https://www.developer.tech.gov.sg/products/collections/data-science-and-artificial-intelligence/playbooks/prompt-engineering-playbook-beta-v3.pdf>

# **Thank you!**