Introduction to Prompt Engineering

What is Prompt Engineering?

- A structured approach to designing inputs for AI systems
- Focuses on clarity, context, and intent to guide model behavior
- Turns vague queries into purposeful, task-oriented conversations
- Applies to simple questions and complex workflows across industries

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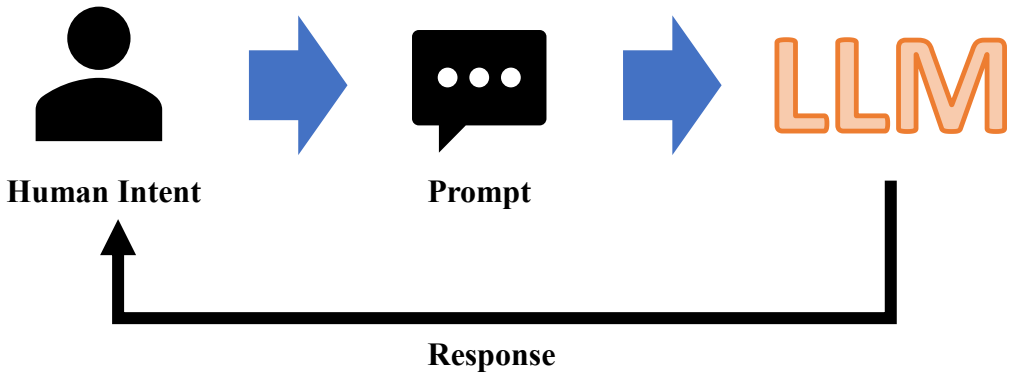
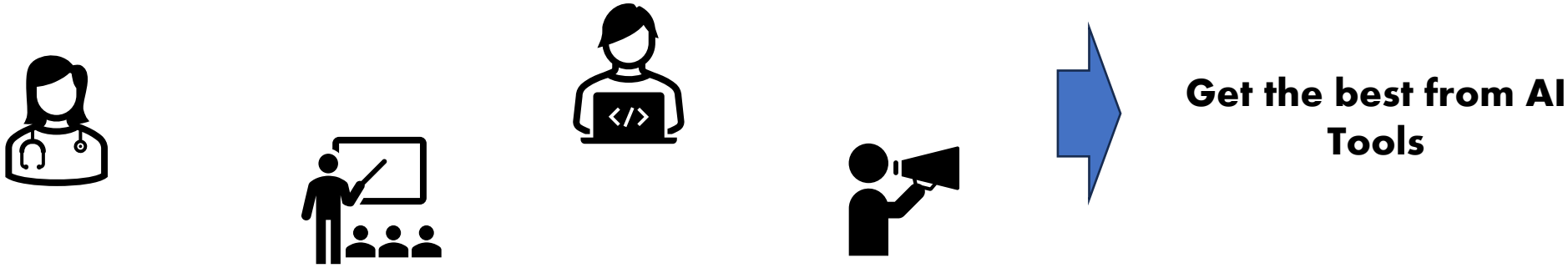
Introduction to Prompt Engineering

What is Prompt Engineering?



Introduction to Prompt Engineering

Why It Matters Across Industries?



Get the best from AI Tools

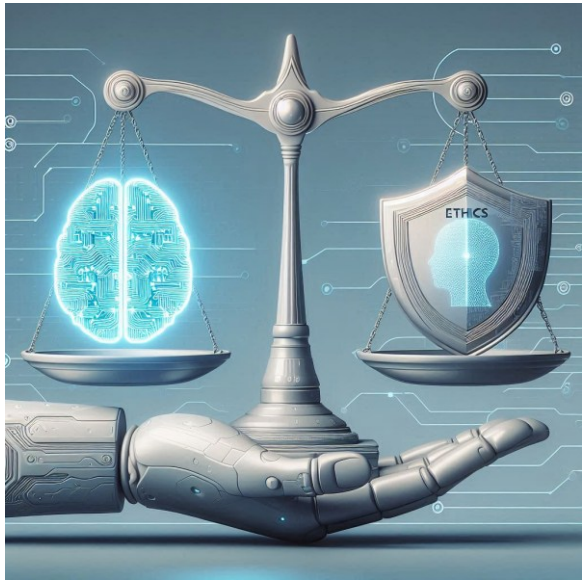
Introduction to Prompt Engineering

Why It Matters Across Industries?

Before Prompting	After Prompting
What is photosynthesis?	You are a biology tutor. Create a study guide on photosynthesis for a high school student who learns best with visuals and analogies.
Gets a mix of links, ads, and Wikipedia	Gets a structured guide with diagrams, key terms, example questions, and analogies like “chloroplasts = solar panels”
Time-consuming and overwhelming	Efficient and focused learning aid

Introduction to Prompt Engineering

Ethical Use of AI



1. Ensure accuracy
Guard against hallucinations, especially in critical domains like health, law, or education. Always verify outputs if real-world consequences exist.

2. Avoid bias
Prompts can unintentionally reinforce stereotypes. Use neutral, inclusive language and be cautious with outputs involving gender, race, culture, or identity.

3. Respect privacy
Never include personal data, sensitive identifiers, or confidential information in your prompts. Treat LLMs as public-facing tools.

4. Check for misuse
Avoid using LLMs to create disinformation, deepfakes, or harmful content. Don’t use AI to generate student essays, fake citations, or abusive dialogue.

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Prompt Engineering Types

Zero-Shot Prompting

Definition: Ask the Large Language Model (LLM) to complete a task with no examples

Application:

- Text Summarization (*Summarize the following text in one sentence*)
- Language Translation (*Translate into French: 'Good evening, how was your day?*)
- Instruction (*Write a poem about the ocean*)
- …

Ask the Large Language Model (LLM) to complete a task with no examples

Prompt Engineering Types

One-Shot Prompting

Definition: Provides the model with a single example of the task you want it to perform

Characteristics:
- Classification
- Translation
- Sentiment analysis
- …

Example1: Translate "Good morning" to Spanish: "Buenos días"
Now translate "How are you?" to Spanish:

Example2: I love this product! → Sentiment: Positive
Now classify: "The service was very slow." → Sentiment:

[Define Task Clearly] ➡ [Provide 1 Example Input → Output] ➡ [Give a New Input for the Model to Process]

Prompt Engineering Types

Few-Shot Prompting

Definition: Few-shot prompting involves providing 2 or more examples in your prompt to demonstrate how the task should be performed

Application:

- Classify Intent
- Language Translation
- Instruction
- …

Example 1:
Sentence: “Can you tell me your store hours?”
Intent: Inquiry

Example 2:
Sentence: “Cancel my appointment for today.”
Intent: Request

Now classify this sentence:
“Please remind me about my meeting tomorrow.”
Intent:

Reminder

Prompt Engineering Types

Example 1:
Convert 5 feet to centimeters.
5 × 30.48 = 152.4 cm

Example 2:
Convert 10 feet to centimeters.
10 × 30.48 = 304.8 cm

Now convert 3 feet to centimeters.

3 x 30.48 = 91.44 cm

Prompt Engineering Types

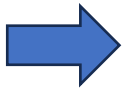
Chain-of-Thought Prompting

Definition: It encourages the model to generate intermediate reasoning steps before producing the final answer

Application:

- Math Problem
- Logic Puzzle
- Medical Triage Reasoning
- …

A patient presents with chest pain, shortness of breath, and a history of heart disease. What should a doctor consider first? **Let's think step by step**.



- Chest pain and shortness of breath are signs of a possible cardiac event.
- History of heart disease increases the risk of a heart attack.
- The doctor should rule out myocardial infarction first.

Answer: Assess for heart attack

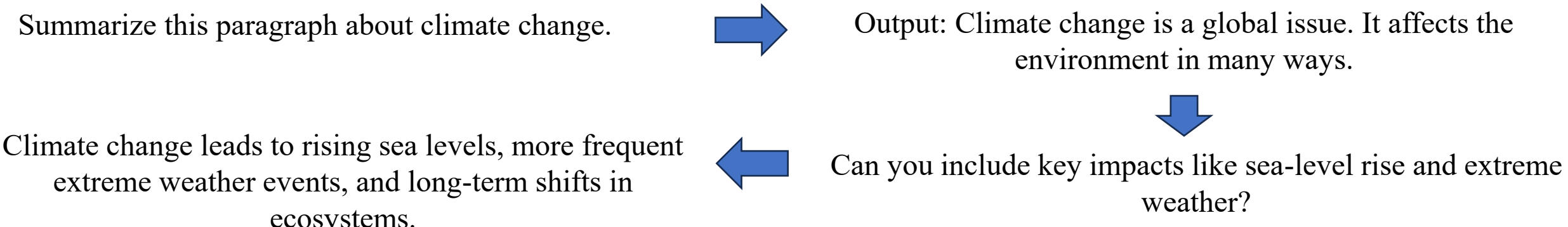
Prompt Engineering Types

Iterative Prompting

Definition: is a method where you refine prompts or inputs over multiple steps to improve or guide the model's response.

Application:

- Writing improvement
- Code debugging
- Complex reasoning
- …



Prompt Engineering Types

Negative Prompting

Definition: Negative Prompting involves explicitly telling the model what NOT to do in its response.

Application:

- Preventing Hallucinations
- Controlling Tone
- Limiting Style
- …

Example 1: Summarize current climate change policies. Keep a neutral tone and avoid using emotionally charged terms like 'crisis' or 'catastrophe.'

Example 2: Write a product review. Do not be sarcastic or overly emotional.

Example3: Write a summary of this article, but do not use bullet points or list format.

Prompt Engineering Types

Role Prompting

Definition: Role prompting is the technique of assigning a specific identity, job, or perspective to the AI to influence its tone, knowledge, and behavior.

Why use it?

- Set tone and expertise
- Improve contextual understanding
- Align responses to audience or task
- …

Prompt Engineering Types

Hybrid Prompting

Definition: Refers to strategically combining two or more prompting techniques—such as few-shot + chain-of-thought + iterative or negative prompting, to guide a language model more effectively.

Why Use It?:

- Solves complex tasks with multiple needs
- Enhances accuracy, control, and depth
- Handles ambiguity, creativity, or reasoning together
- …

Prompt: Write a paragraph explaining quantum mechanics to a 10-year-old.

Response: Quantum mechanics is a complex field involving subatomic particles...

Revised Prompt: That sounds too technical. Explain using a kid-friendly story without mentioning 'particles' or 'equations.'

Iterative + Negative Prompting

Prompt Engineering Types

Exercise

Goal: Write a professional response to a customer complaint about a delayed product delivery, but do not blame the shipping carrier, and maintain an empathetic tone.

Role Prompting + Negative Prompting + One-Shot Prompting

You are a **Customer Support Specialist** at a premium e-commerce brand.

Do **not** blame the shipping carrier or make excuses. Be professional and empathetic.

Example:
"We truly understand how frustrating delays can be, especially when you're excited about receiving something you've ordered. Please accept our sincere apologies for the inconvenience. We're already working to ensure your order arrives as soon as possible, and we appreciate your patience and understanding.

Now, write a response to this complaint: "I placed my order 10 days ago and still haven't received anything. This is ridiculous!"

Prompt Engineering Types

Exercise

Goal: Write a professional response to a customer complaint about a delayed product delivery, but do not blame the shipping carrier, and maintain an empathetic tone.

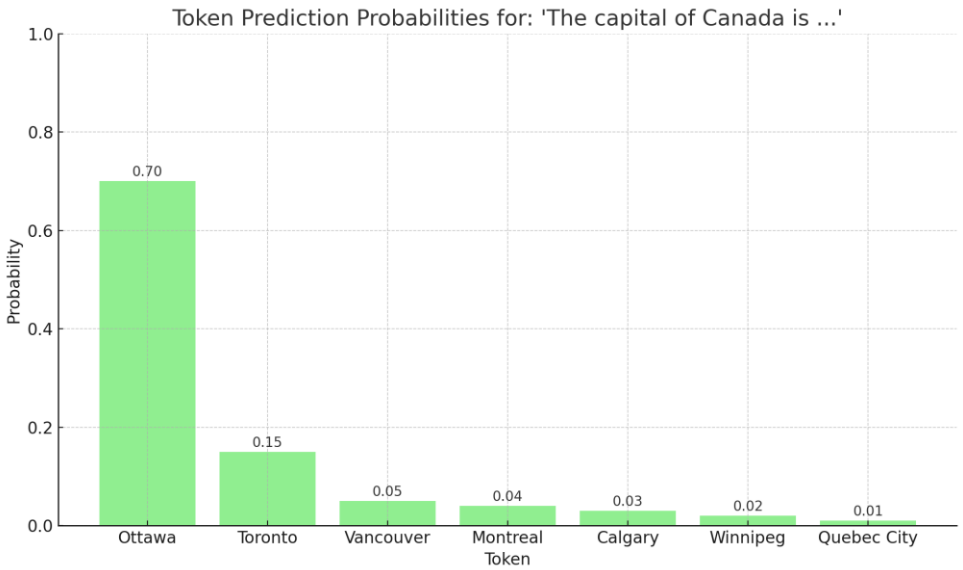
Thank you for reaching out, and I'm truly sorry to hear that your order hasn't arrived yet. We completely understand how disappointing this must be—especially after waiting for 10 days—and we sincerely apologize for the delay.Please know that we're already looking into this with urgency to ensure your order gets to you as quickly as possible. We'll follow up shortly with an update on its status.Your experience matters deeply to us, and we appreciate your patience and understanding while we resolve this for you. If there's anything else we can assist you with in the meantime, please don't hesitate to let us know.

Understanding Large Language Models

How LLMs Work

- LLMs predict the **next token** (word or piece of a word) in a sequence.
- Each token is selected based on probabilities from training data.
- The model doesn't know facts; it generates the most likely continuation.

The capital of Canada is …



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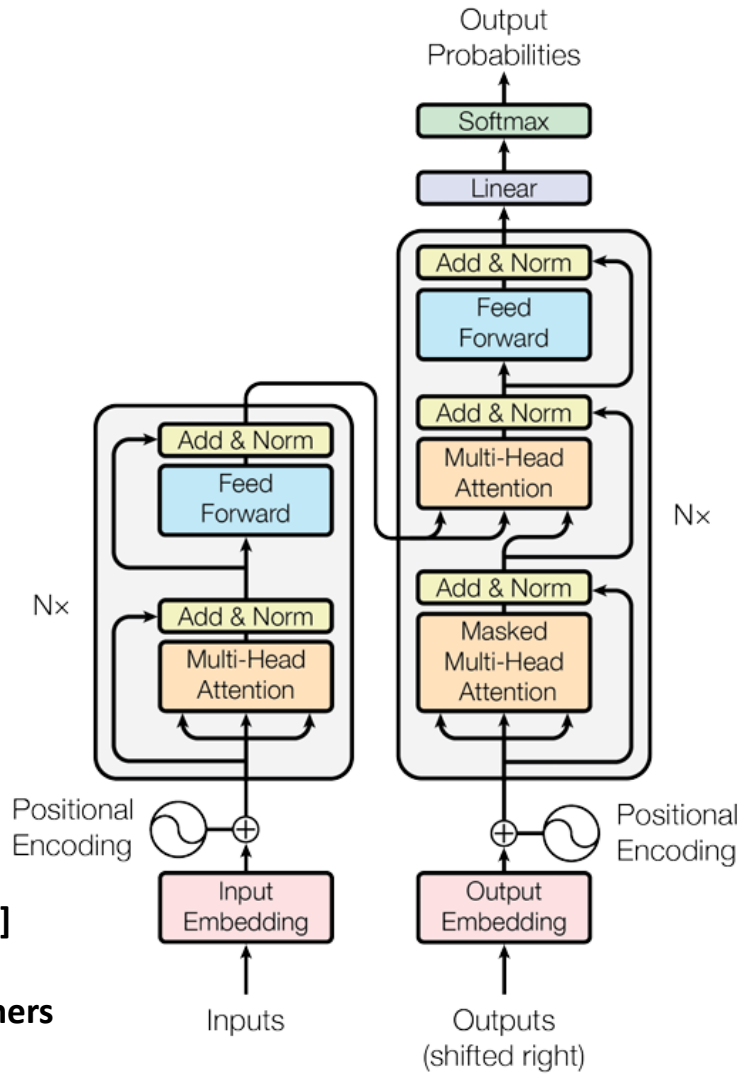
Understanding Large Language Models

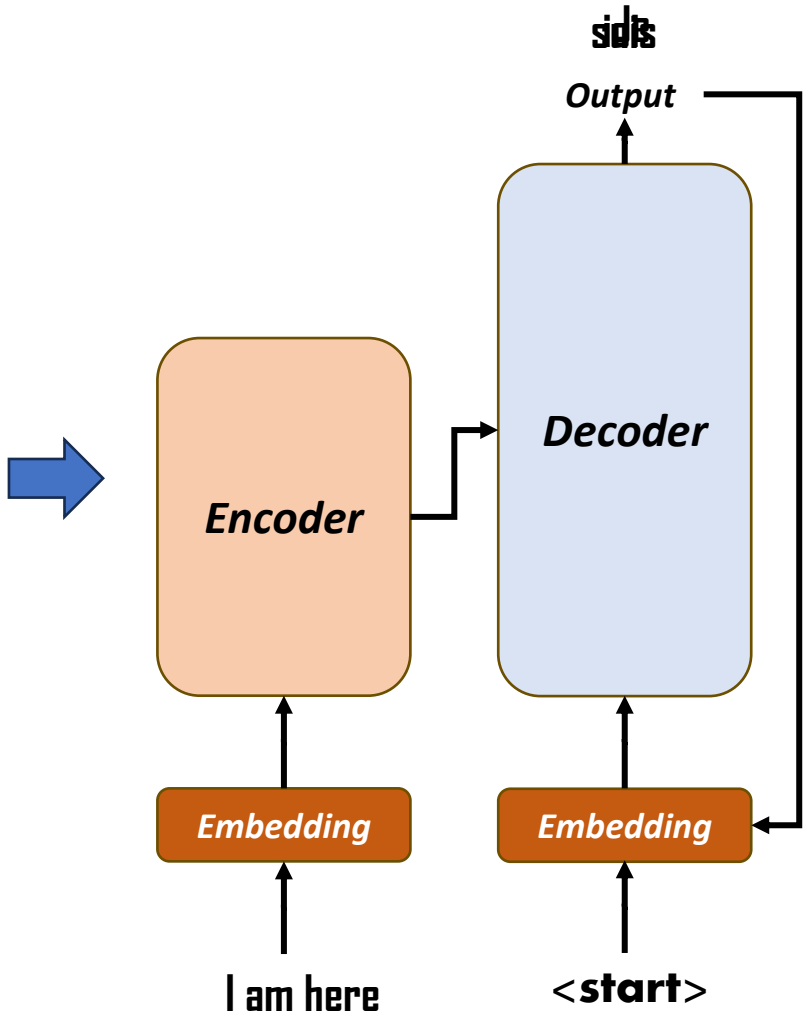
Popular LLMs

Model	Organization	Access Type
GPT	OpenAI	API, Chatgpt
Claude	Anthropic	API,Claude.ai
Gemeni	Google	API, Google Bard
LLaMA	Meta	Open-source
Mixtral	Mistral.ai	Open-source
Titan	Amazon	Amazon Bedrock

Deeper into LLMs

Transformers





Reference: Vaswani et al paper (Attention Is All You Need)

Deeper into LLMs

Why Understanding Transformers!

- **Transformers Power Modern LLMs**
  - Core architecture behind GPT, BERT, T5, Claude, etc.
  - Enables attention-based understanding of context

- **Prompts Interact with Attention Mechanisms**
  - The way you phrase input affects token attention
  - Positional and semantic cues guide model focus

- **Effective Prompting Leverages Tokenization + Attention**
  - Knowing how text gets split (tokens) helps design better prompts
  - Prompt structure influences response quality via attention layers

- **Few-Shot, Chain-of-Thought = Prompting Patterns Designed for Transformers**
  - These techniques guide model behavior via learned attention weights
  - Prompts are not magic, they activate transformer internals purposefully

Crafting Effective Prompts

Clarity and Specificity

- Avoid vague wording
- Use direct language and constraints
- Define the output format, if needed

Crafting Effective Prompts

Provide Context and Background

- AI performs better when understands the context
- Include necessary background or definition in your prompt
- Add Framing details, roles and goals

Crafting Effective Prompts

Exercise

You are creating a prompt for an LLM to help generate an explanation of photosynthesis aimed at teenage students (ages 13–17). Your goal is to get a response that is accurate, age-appropriate, and engaging.

❌Vague prompt:
Explain photosynthesis.

Your task is to rewrite it using what you've learned:
- **Make it clear and specific**
- **Add context and background**

Your New Prompt Should Answer:
- Who is the audience?
- What tone or language style is needed?
- What format do you want? (e.g., paragraph, bullet points, analogy?)

Crafting Effective Prompts

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Prompt Tuning and Optimization

Iterative Testing

- Start simple, evaluate output
- Tweak wording to reduce ambiguity
- Re-test and compare outcomes
- Log what works and what doesn’t

Prompt Tuning and Optimization

Why Go Beyond the Web Interface?

- Web interface = simple & user-friendly
- API = flexible, scalable, and customizable
- Automate tasks and integrate with other systems
- Control model behavior with parameters such as: ***temperature, max_tokens, top_p, etc.***

Prompt Tuning and Optimization

The Power of Parameters

Text generation

Parameter	What It Does?	Example Use Case
temperature	Controls randomness (0 = stable, 1 = creative)	Creative writing vs. factual QA
max_tokens	Limits output length	Short summaries vs. full essays
top_p	Filters unlikely words for focus	Guided exploration

Prompt Tuning and Optimization

The Power of Parameters

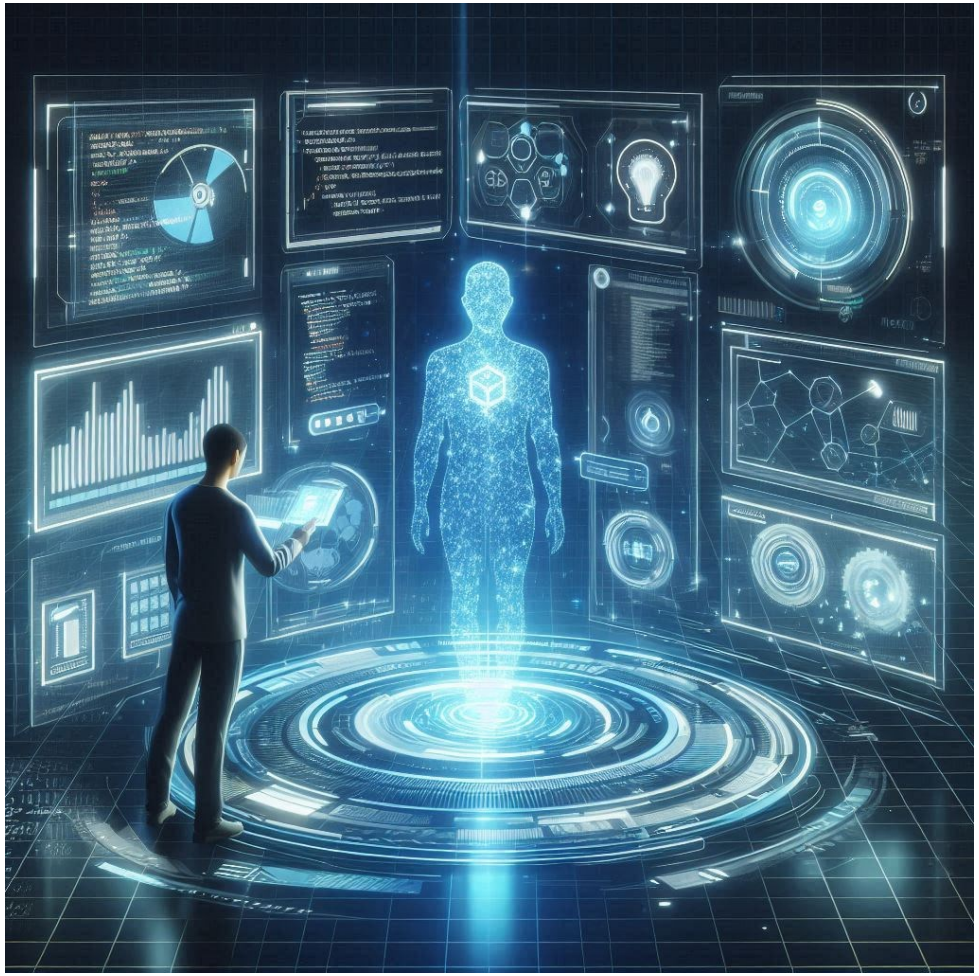
Image Generation

Parameter	What It Does?	Typical Range / Options
width/height	Controls the size (resolution) of the output image.	Integer Pixels (e.g., 512–1024)
guidance_scale	1.0 – 20.0 (common: 7.5–12.0)	Strength of prompt adherence. Higher = more faithful to prompt, but less creative.
style	Keywords like "photorealistic", "anime", "sketch"	Helps control overall aesthetic (model-specific)
seed	Controls randomness. Same seed + same prompt = same image	Integer

Meta Prompting

What is Meta Prompting?

- Prompting the AI to generate, critique, or refine other prompts
- Useful for improving prompt design, automating prompt creation, or teaching best practices
- Common in advanced applications and prompt optimization loops



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Meta Prompting

What is Meta Prompting?

Direct Prompting → Write a philosophical quote in the style of Khayyam

Meta Prompting → You are an expert in prompt engineering. Write a precise prompt that would get an AI to generate a philosophical quote in the style of Khayyam. The quote should reflect themes of time, fate, and the ephemeral nature of life, using poetic language and classical imagery.

↓

Generated Meta Prompt

Write a poetic and contemplative quote in the style of Khayyam, focusing on the fleeting nature of time, the uncertainty of fate, and the beauty of transient moments. Use classical Persian imagery like wine, gardens, stars, and dust.

AI Hallucination and How Prompting Can Reduce It

What Is AI Hallucination?

- AI hallucination = When an AI confidently outputs false or fabricated information
- Often sounds reasonable, but may be incorrect or completely made up
- Especially risky in areas like healthcare, law, education, and news

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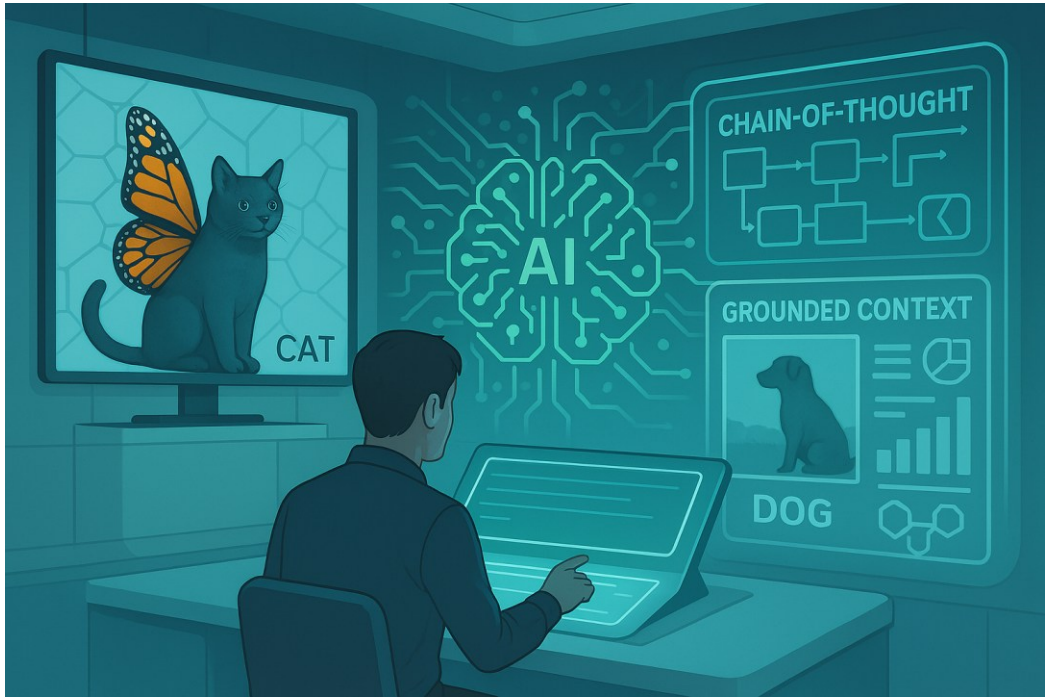
AI Hallucination and How Prompting Can Reduce It

Why Do LLMs Hallucinate?

- No built-in “truth database” - models are pattern predictors, not fact checkers
- Lack of external grounding or source retrieval
- Training data may contain noise, fiction, or outdated facts
- Prompt quality directly affects risk



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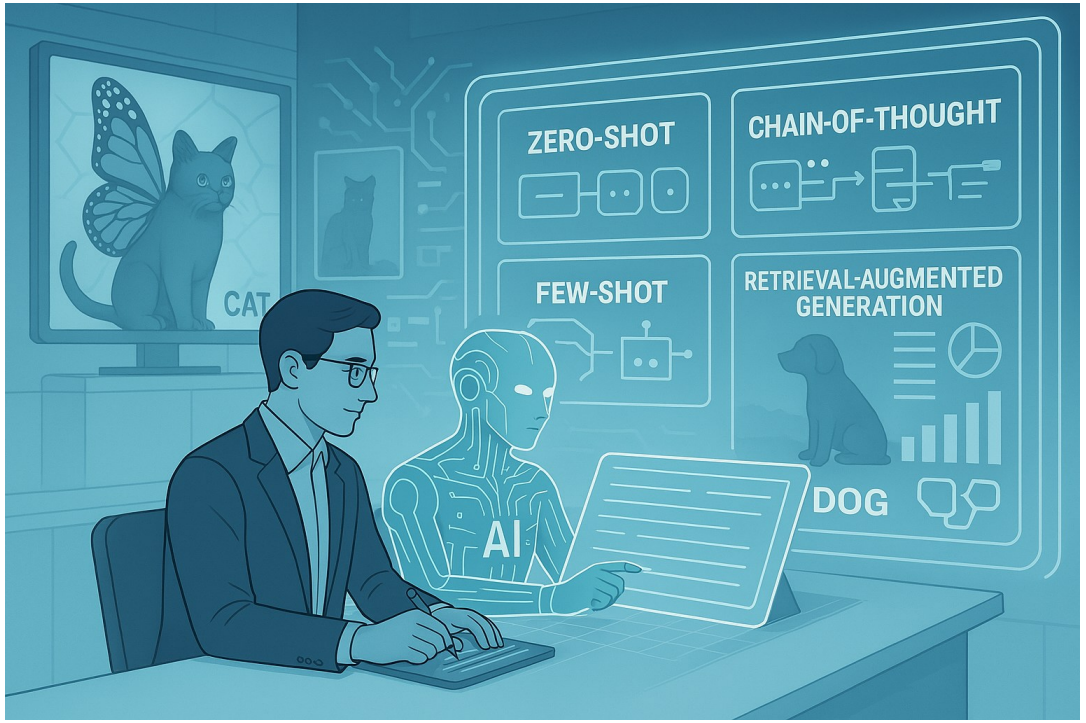
AI Hallucination and How Prompting Can Reduce It

Prompting Techniques to Reduce Hallucination

- Add constraints: “Only answer if you're certain” or “cite a source if possible”
- Specify role: “You are a fact-checking assistant”
- Set output format: “List sources after each claim”
- Use retrieval-based prompts: “Based on the provided document…”
- Use negative prompting: “Avoid guessing or fabricating details”



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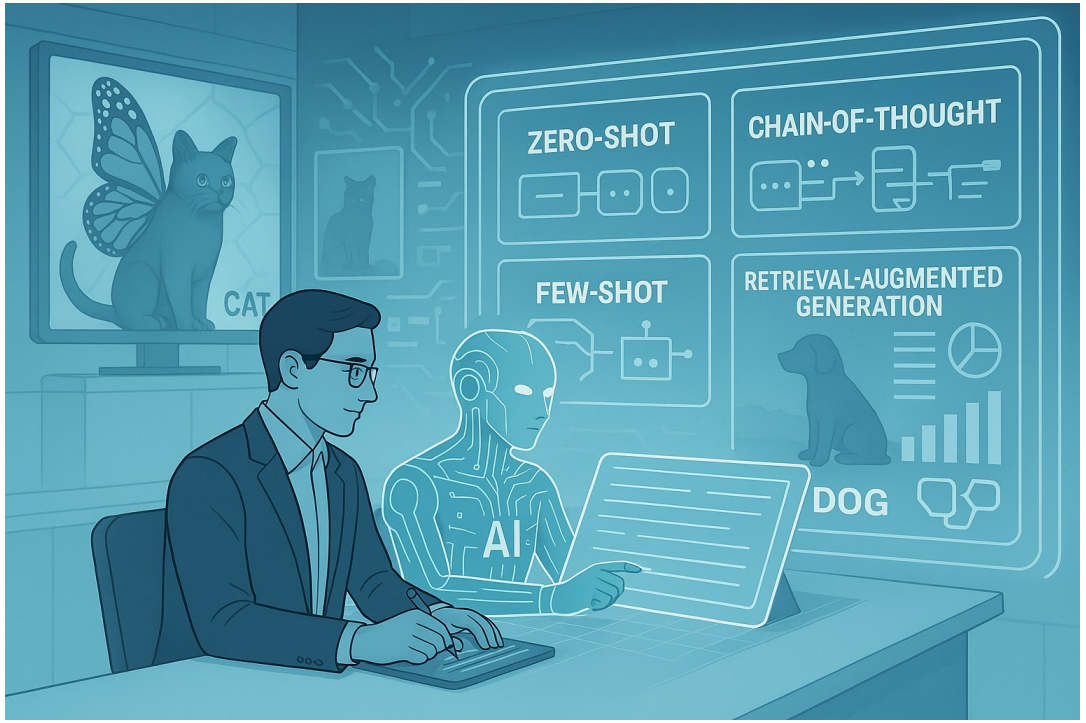
AI Hallucination and How Prompting Can Reduce It

Best Practices for Hallucination - Aware Prompting

- Don’t assume facts in your question
- Ask for citations or disclaimers
- Use system-level instructions to reduce overconfidence
- In critical use cases, verify everything externally



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AI Hallucination and How Prompting Can Reduce It

Example 1

❌ Prompt That Encourages Hallucination:

- List three peer-reviewed articles where Alan Turing discusses artificial intelligence.

✅ Improved Prompt to Reduce Hallucination:

- Did Alan Turing publish any works that are considered foundational to the field of artificial intelligence? If so, cite known works like 'Computing Machinery and Intelligence'. If no specific AI-focused papers exist, say so clearly.

AI Hallucination and How Prompting Can Reduce It

Example2

❌ Prompt That Encourages Hallucination:

- What are the top 5 performance features of the 2026 Tesla Model X?

✅ Improved Prompt to Reduce Hallucination:

- Based on your latest available knowledge, what are the known performance features of the Tesla Model X as of 2025? Do not speculate about unreleased 2026 details. If unknown, say so.