

# AI, LLM & Prompt Engineering

- Speaker:  
Dr. Haowen Jiang
- Date:  
Oct 24th, 2024



A portrait of a young wizard for my children's book cover |

# Outline

- My background
- Intro to AI
- Large Language Models (LLMs)
- Prompt Engineering
- Q & A

# My background



# Education



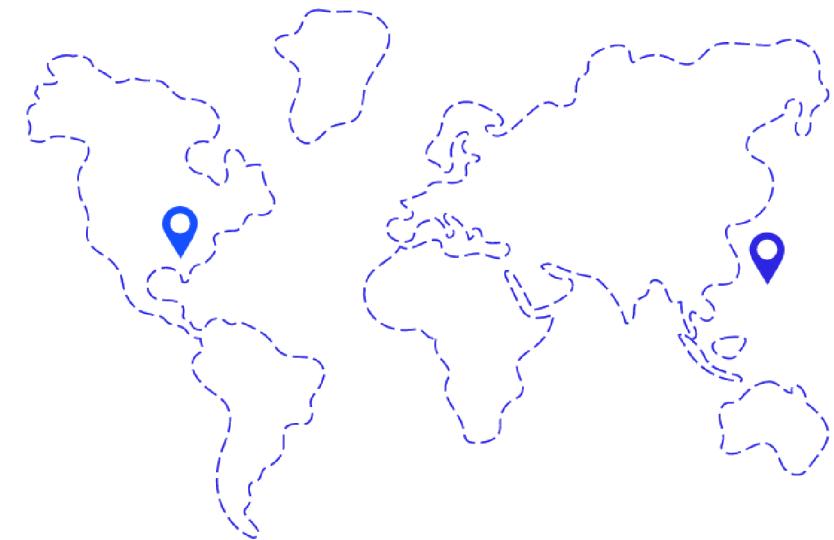
## Nat'l Taiwan University

MA, Linguistics  
BA, Foreign Languages



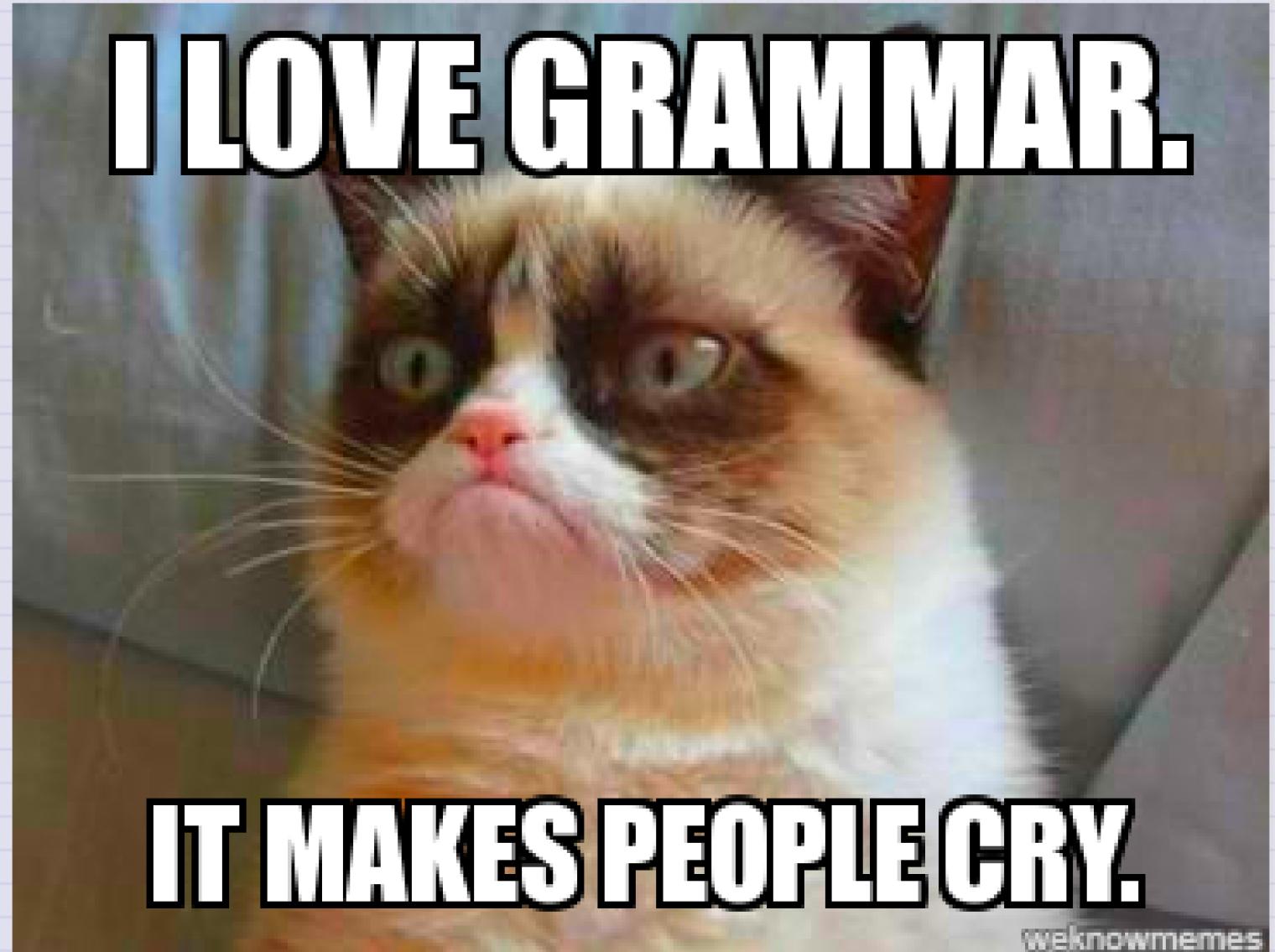
## Rice University

PhD, Linguistics  
MA, Linguistics



## Experience

-  English lecturer at *Nat'l Taipei University of Technology*



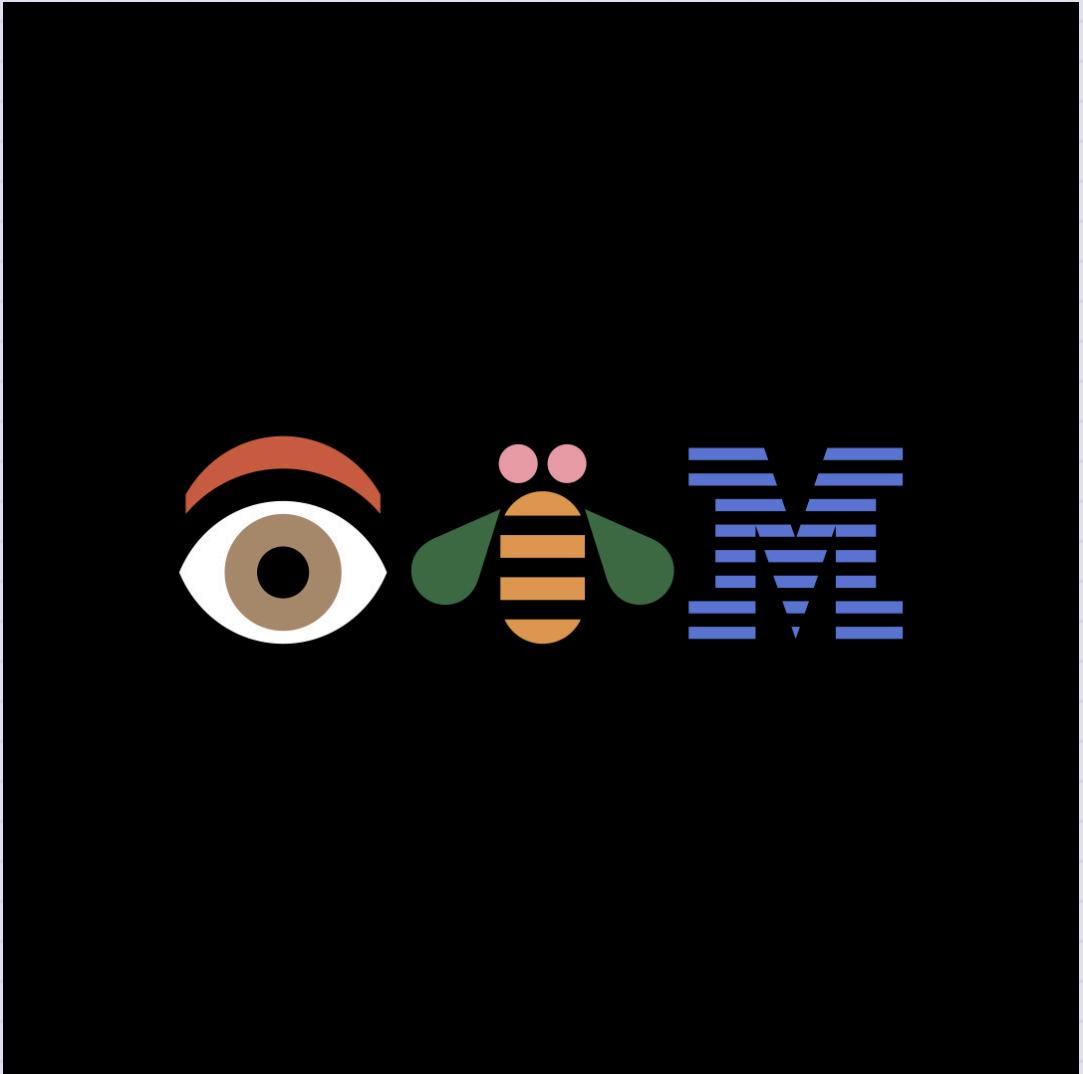
## Experience

-  Postdoc researcher at *Peking University*



# Experience

- 🤖 AI engineer at **IBM** (my 5th industry job)



# IBM Business Divisions

[>> source](#)

## IBM (IBM) Last Update 10/25/22

Related: [ADP](#) [PAYX](#)

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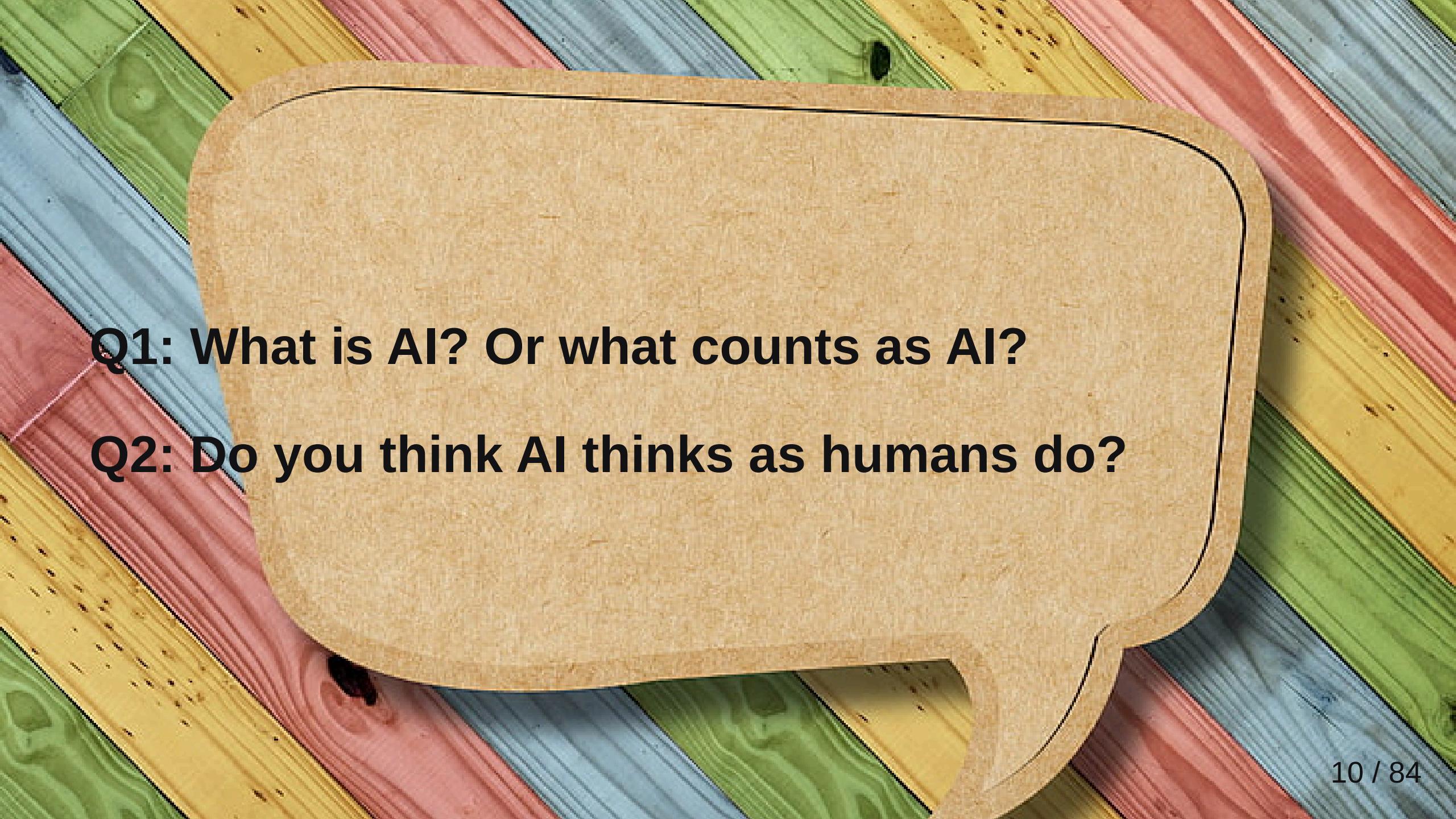
[Adjusted EBITDA](#)

[Free Cash Flow](#)



# Intro to AI





**Q1: What is AI? Or what counts as AI?**

**Q2: Do you think AI thinks as humans do?**

# DIFFERENCES BETWEEN ARTIFICIAL INTELLIGENCE MACHINE LEARNING & DEEP LEARNING

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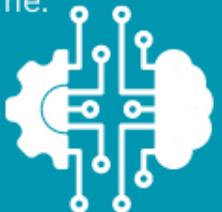
## Artificial Intelligence

A broad concept that involves creating machines that can think and act like humans



## Machine Learning

A subset of AI that focuses on creating algorithms that enable computers to learn from data and improve their performance over time.



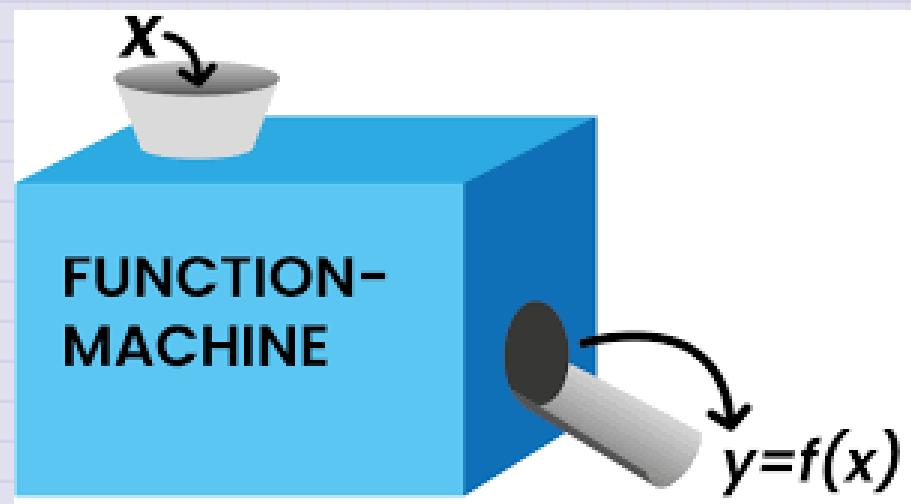
## Deep Learning

A subset of machine learning that focuses on neural networks with many layers.



# Searching for a function

- The goal of ML/DL is to search for a *function* that takes some input and then produces some output in a way that humans would normally do.



# Function

- Natural Language

We like languages >>> LIKE(We, languages)

- Programming

```
def like(subj, obj):  
    print(f"{subj} like {obj}.")  
  
like("We", "languages")
```

Try it out >> [here!](#)

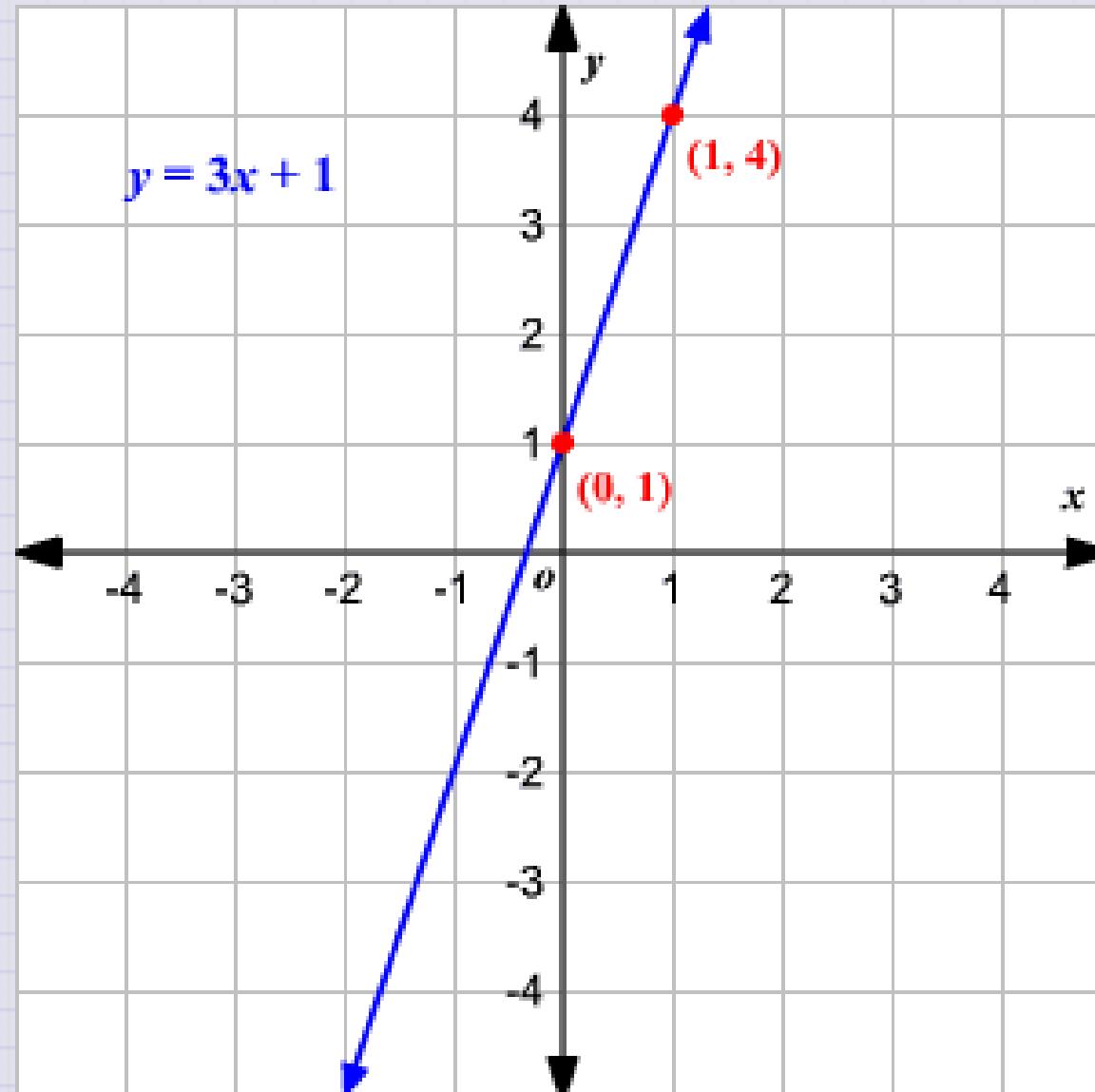
# Data-driven AI

A data-driven model  
is trained on data points  
instead of being coded  
upfront.

```
inputs = [0, 1, 2] # the x variable  
outputs = [1, 4, 7] # the y variable
```

Random:  $y = 0.1x + 0.5$

Trained:  $y = 3x + 1$



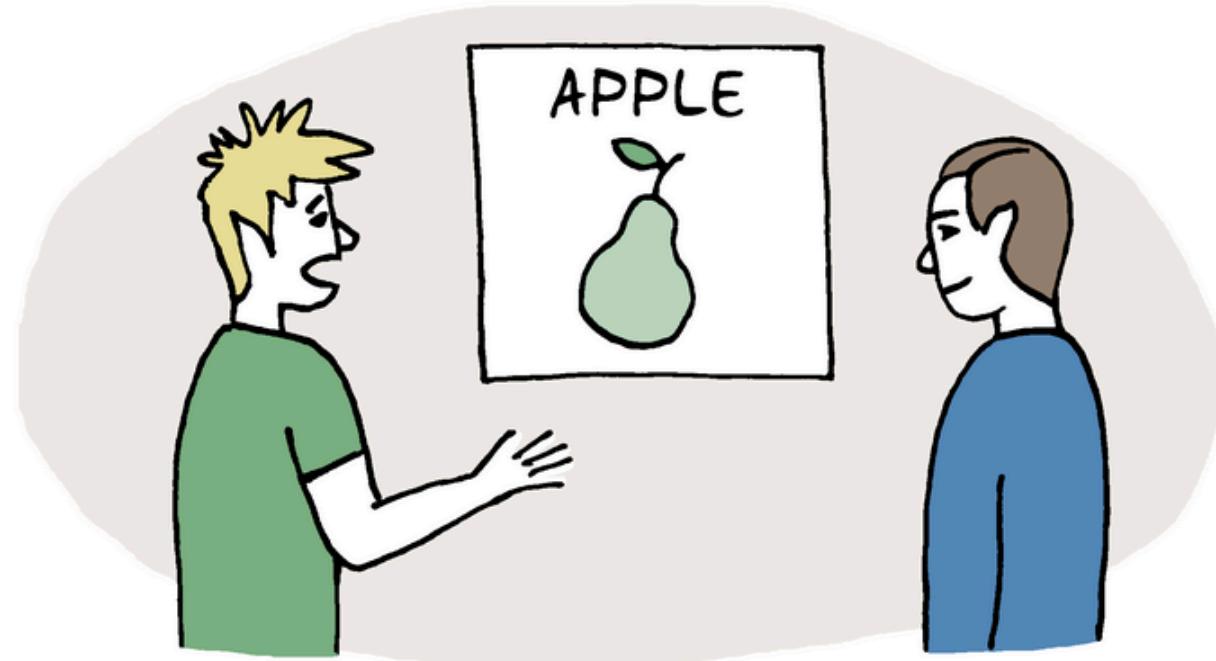
## How do machines learn?

Machines learn by trial and error, just as humans do.



# Machine Guessing

# MACHINE LEARNING

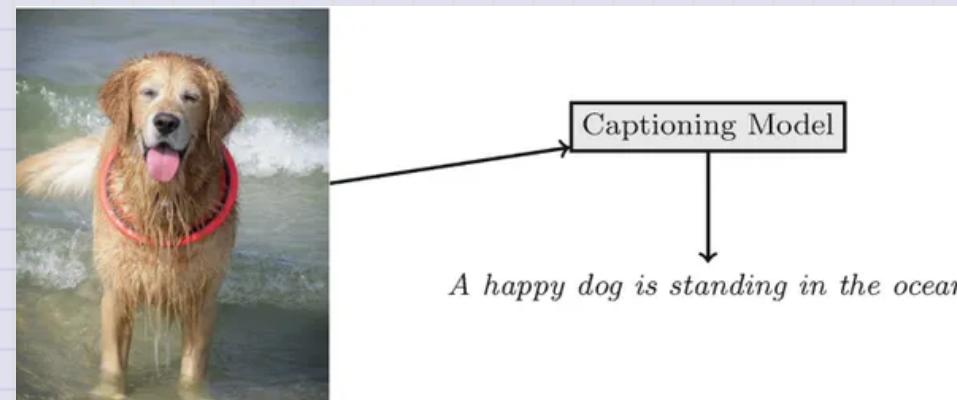


WELL, A MORE ACCURATE  
NAME WOULD BE  
**MACHINE GUESSING**

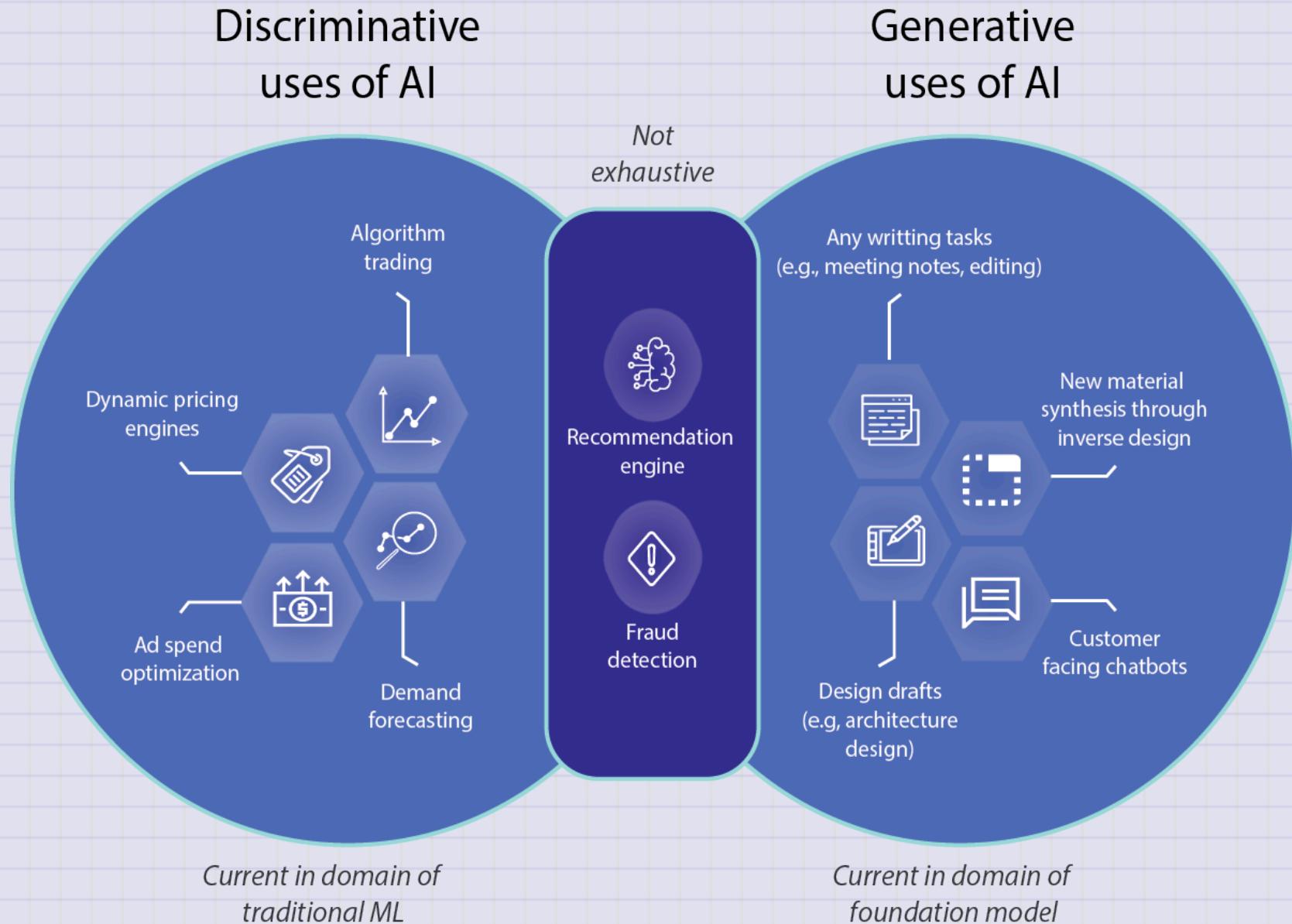
# Why is machine learning powerful?

The true power of ML/DL lies in the fact that

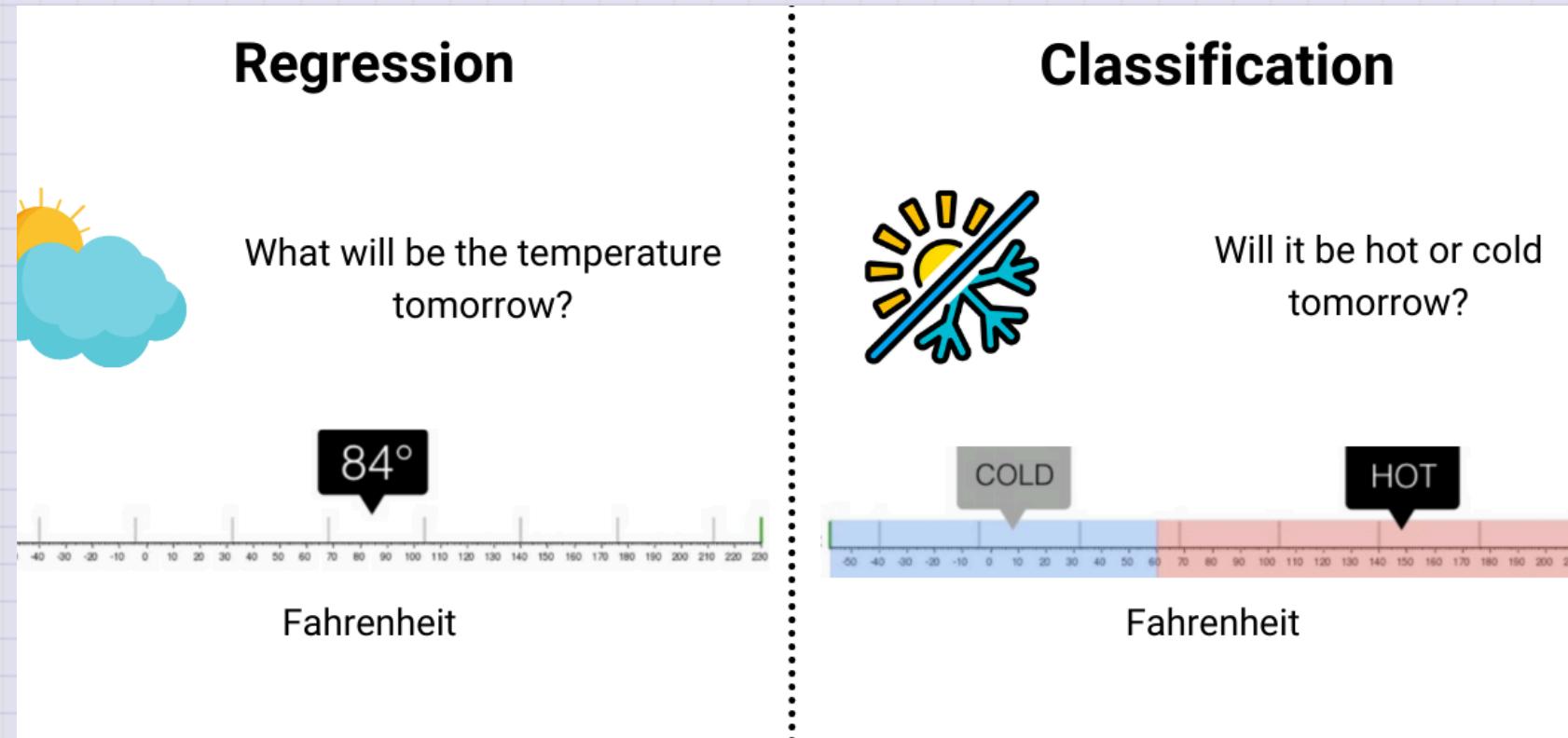
- humans only need to provide input and output
- computers are in charge of figuring out the right process, which is called a **model**



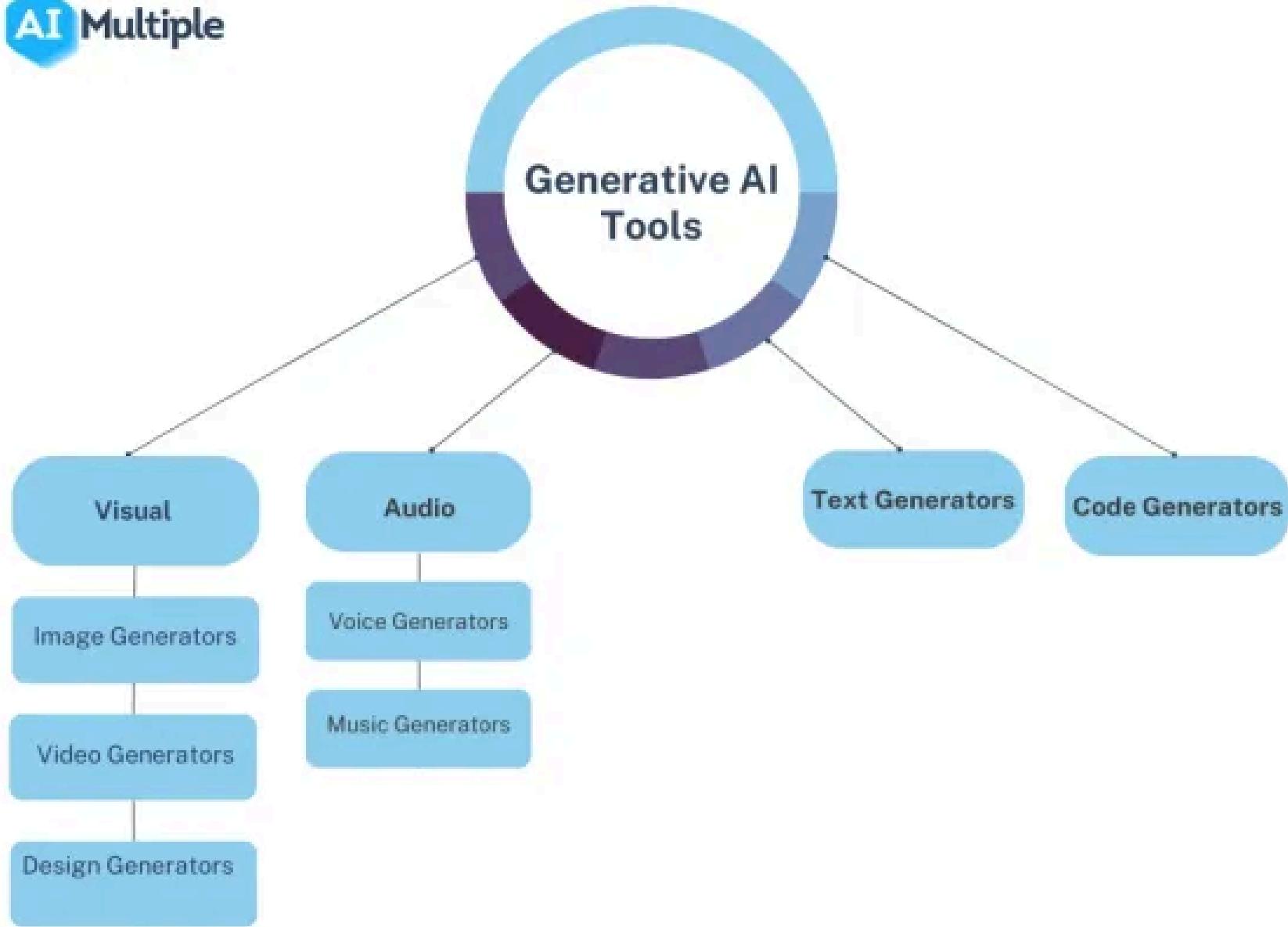
- 2 types of AI



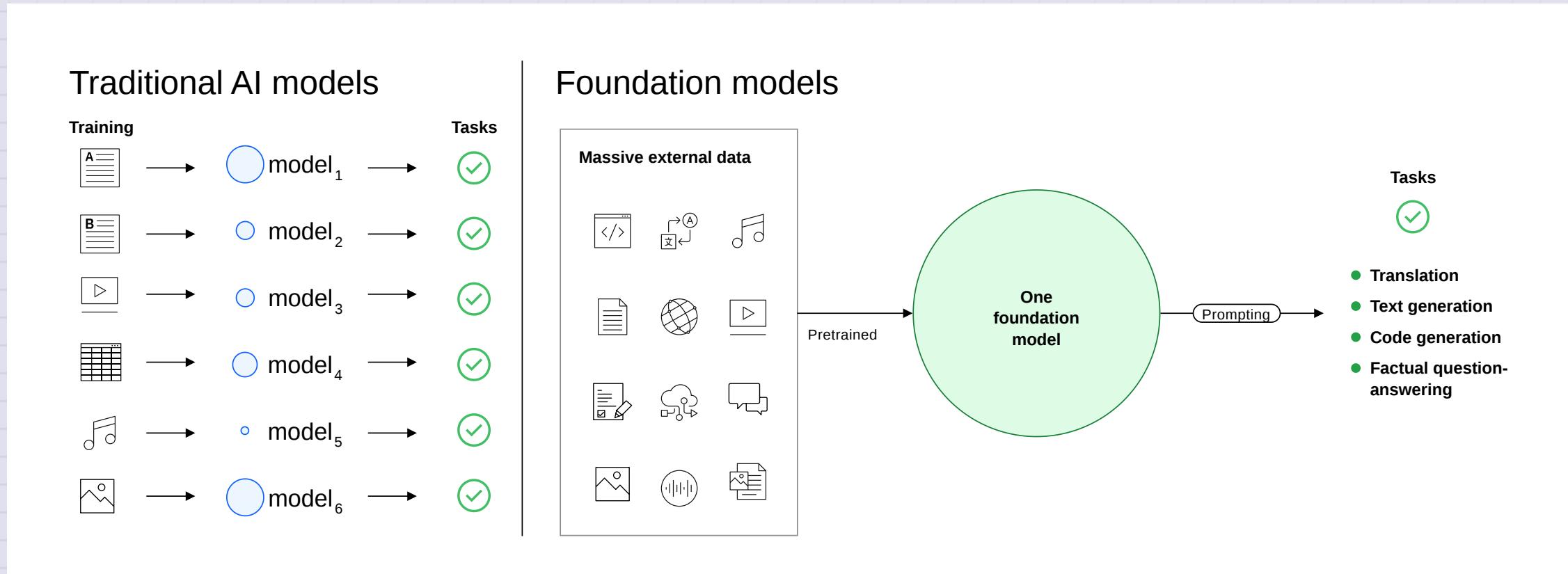
- 2 types of discriminative models



- 4 types of generative models



- Traditional AI vs Generative AI



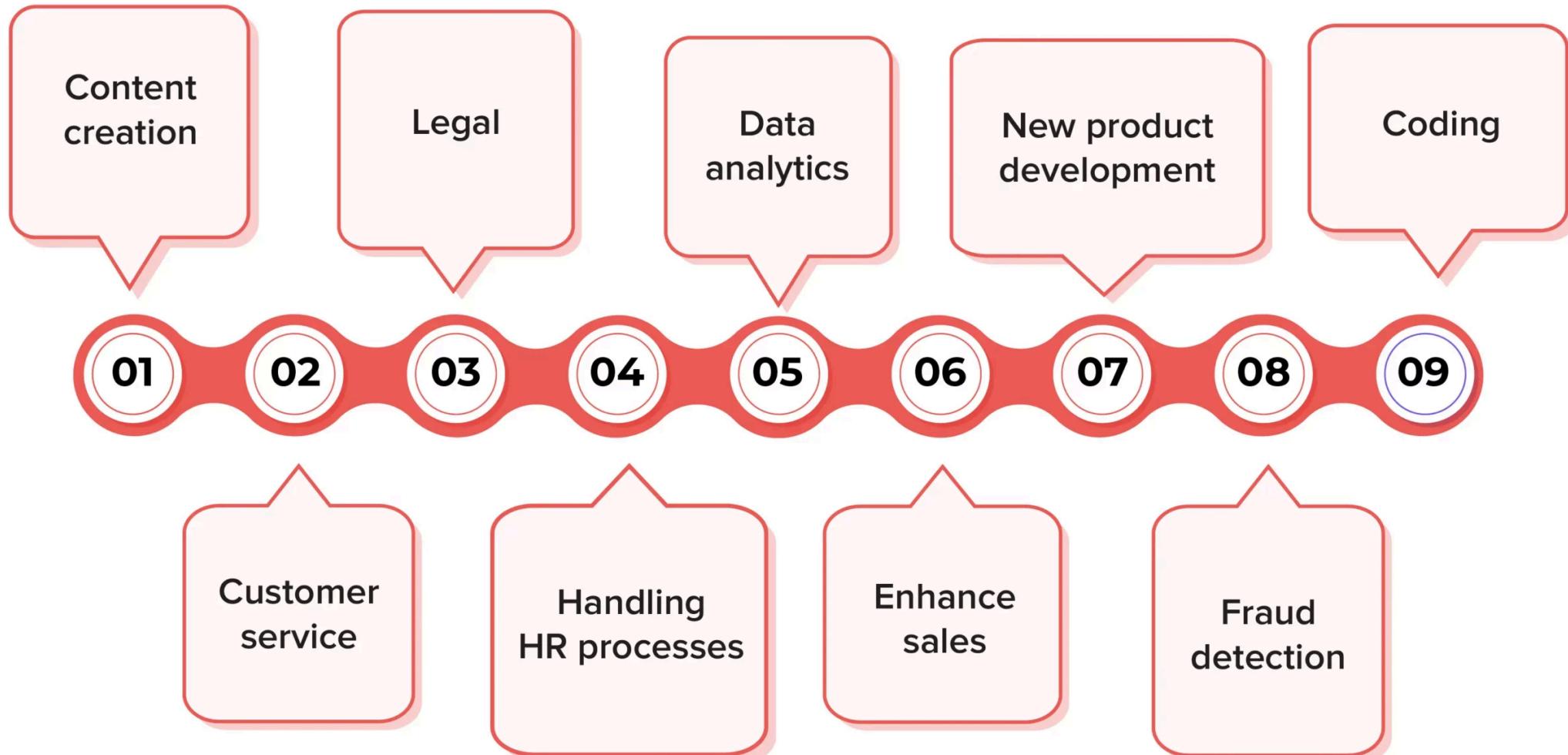
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**Nearly two-thirds (64%) of business leaders feel a high sense of urgency to adopt generative AI, with 62% feeling their organisation lacks the critical skills required to execute their AI strategy.**

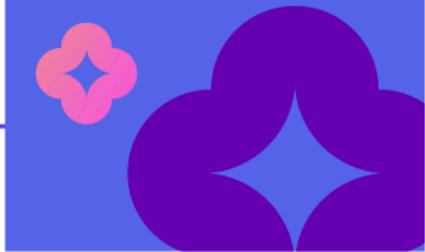


Source: AIPRM

# Use cases of generative AI for business



[>> source](#)



# Applications of **Generative AI in the Education Industry**

Adaptive Learning

Content Generation

Automated Grading

Personalized Tutoring

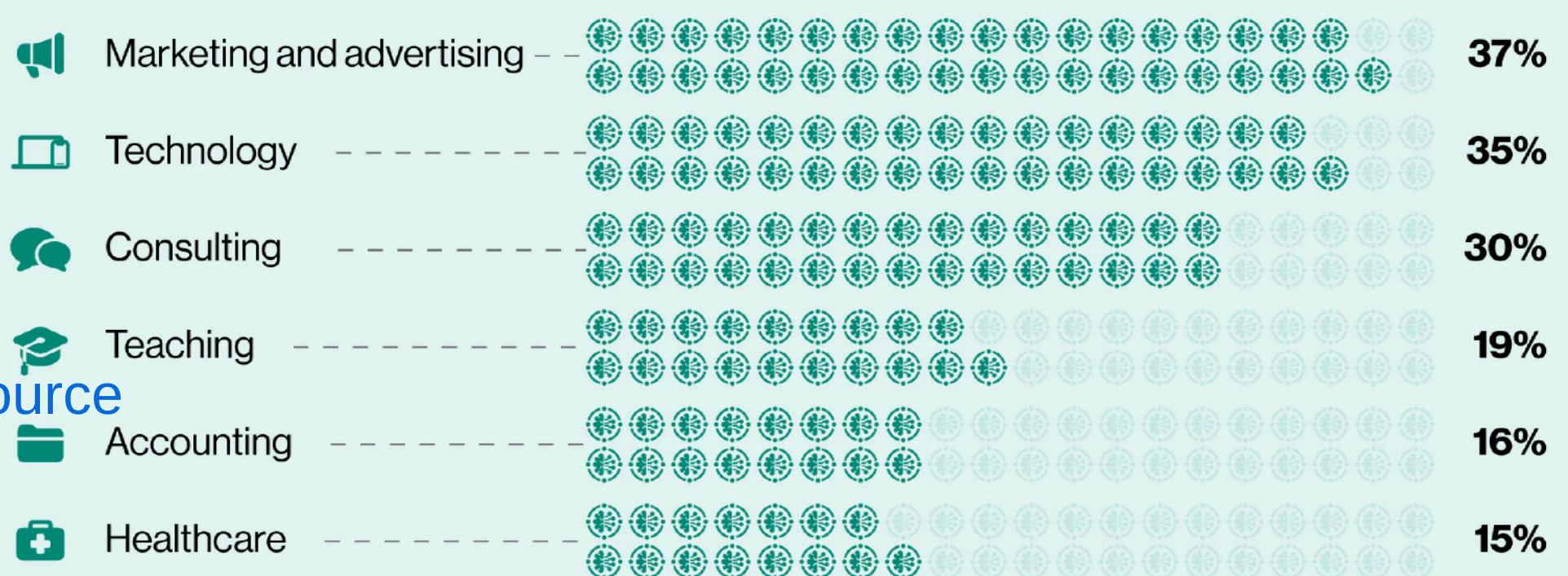
Virtual Simulations

Intelligent Learning  
System



XENONSTACK

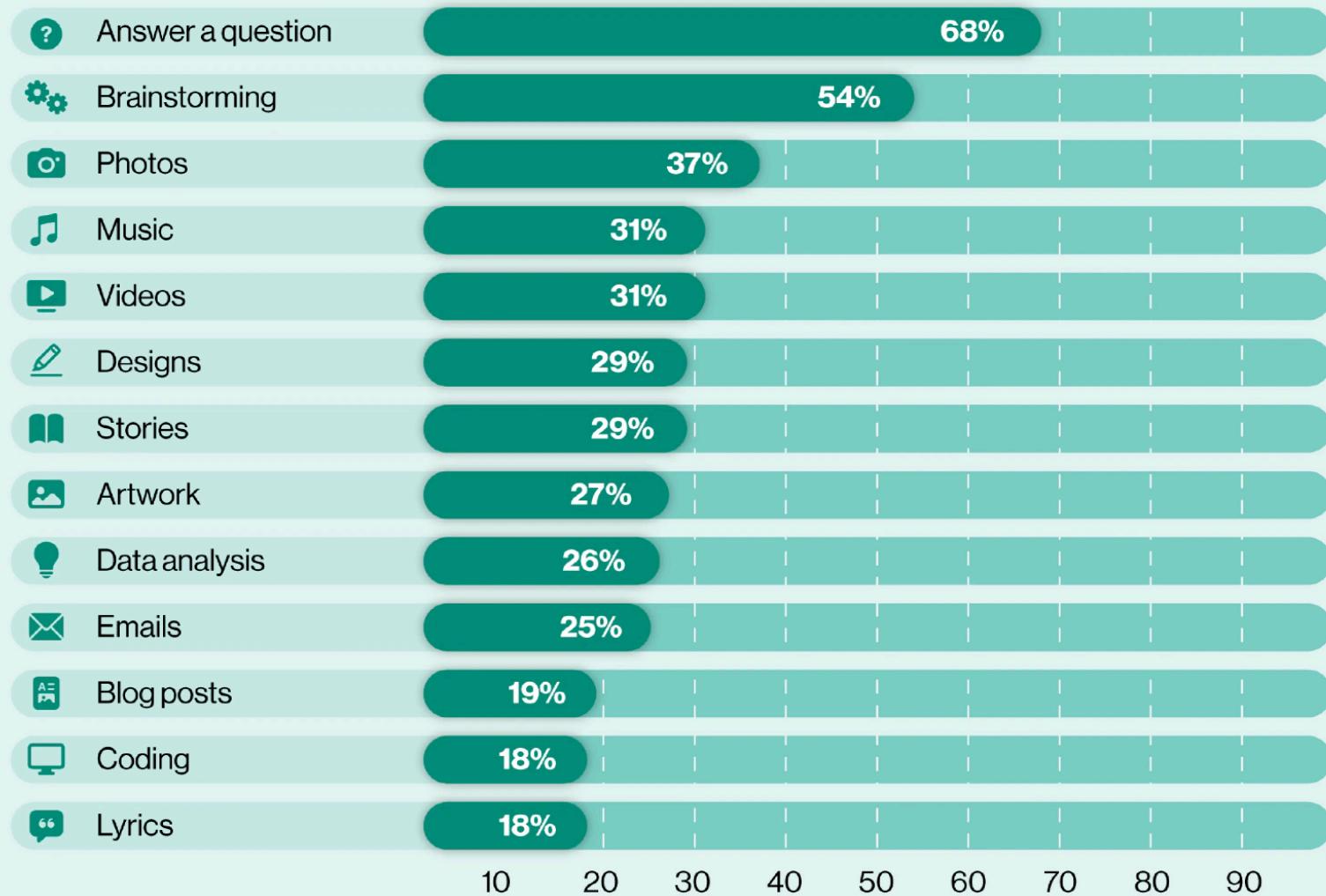
**Industry**  =10%



>> SOURCE

**Percentage of companies using generative AI to help with daily processes**

Source: Statista

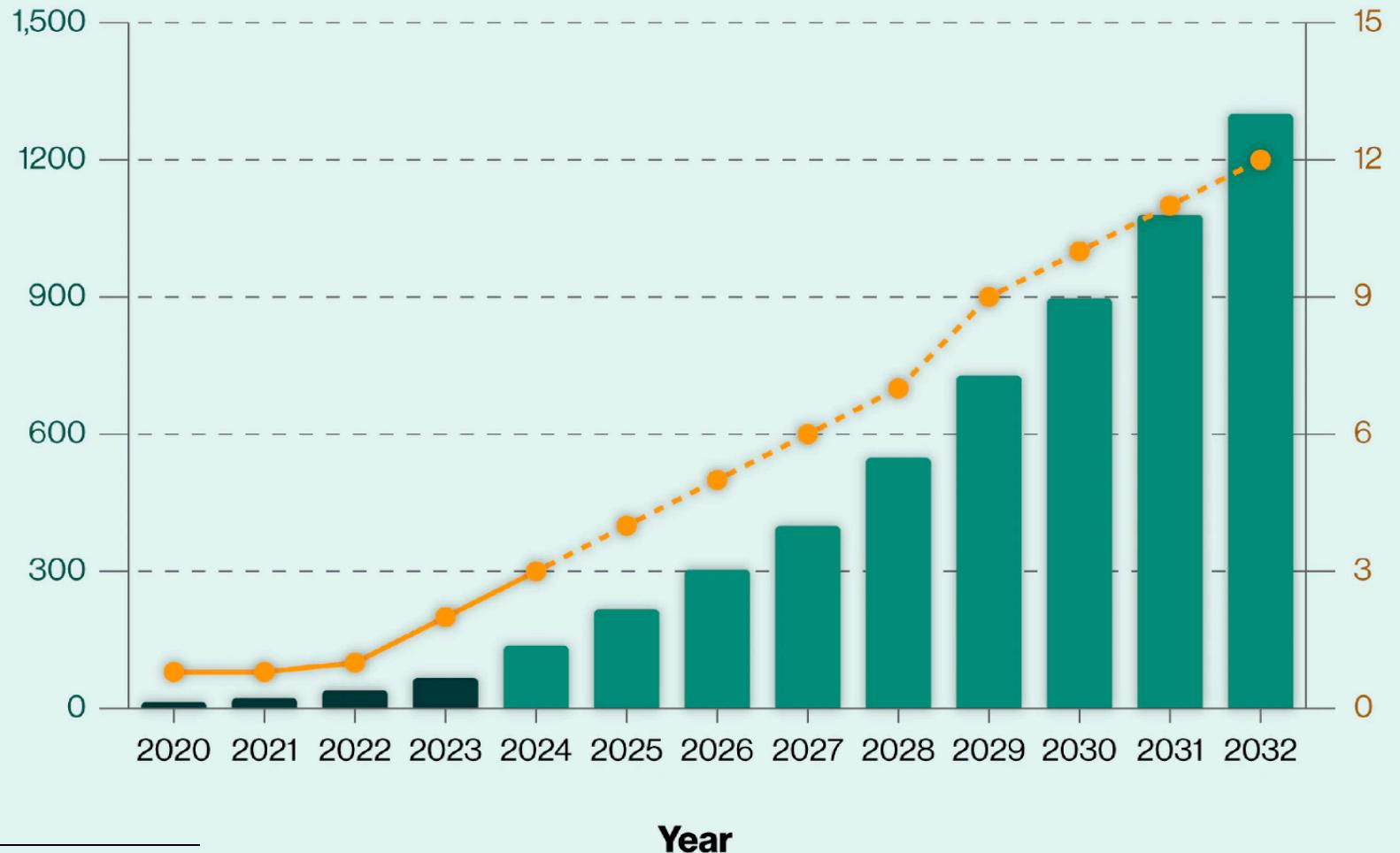
[\*\*>> SOURCE\*\*](#)**Task**

**Percentage of survey respondents who used generative AI for this reason**

| Current | Projected

■ Global generative  
AI revenue (\$ billions)

Percentage of global I.T. that  
comes from generative AI (%)

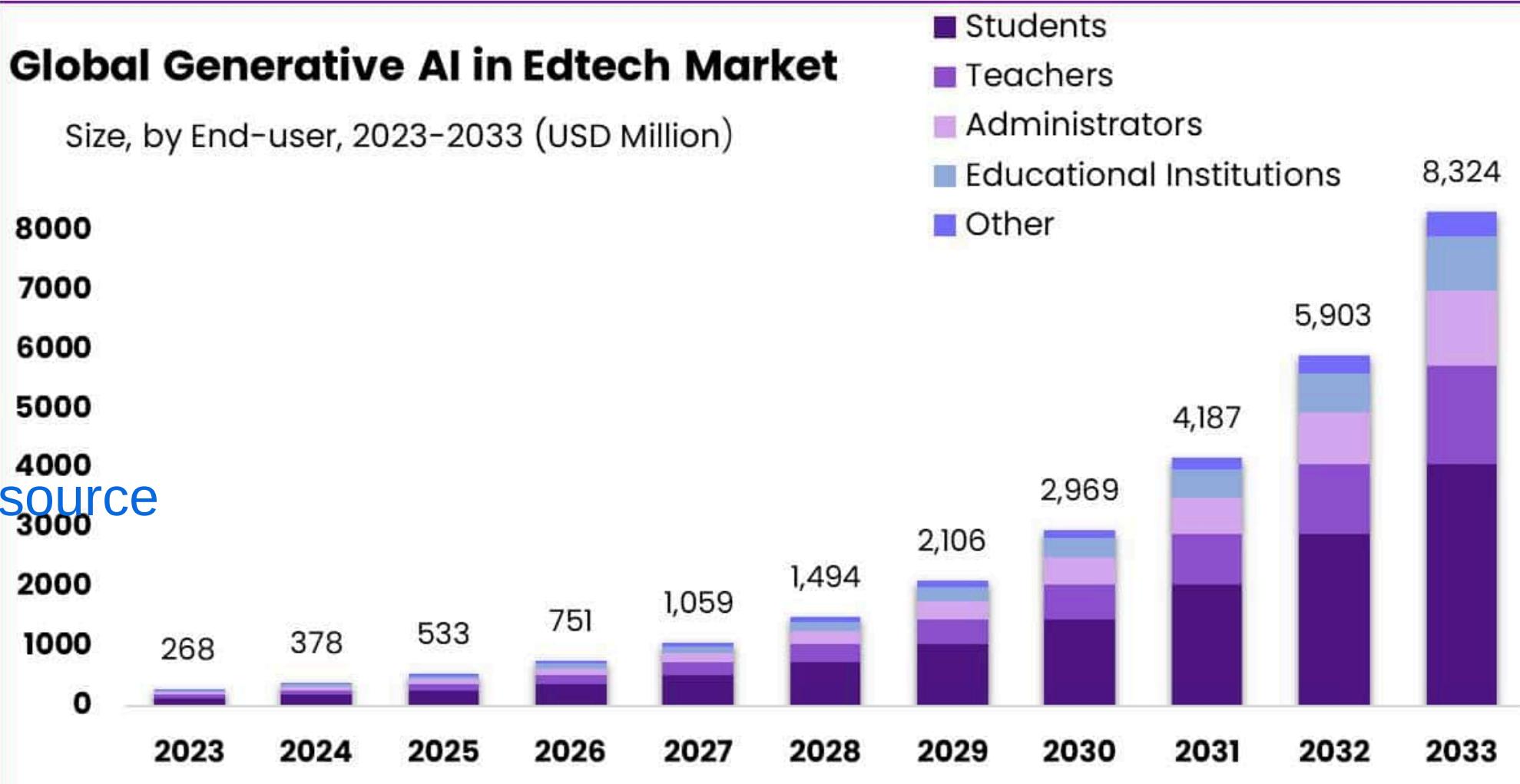


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## Global Generative AI in Edtech Market

Size, by End-user, 2023-2033 (USD Million)

>> [SOURCE](#)



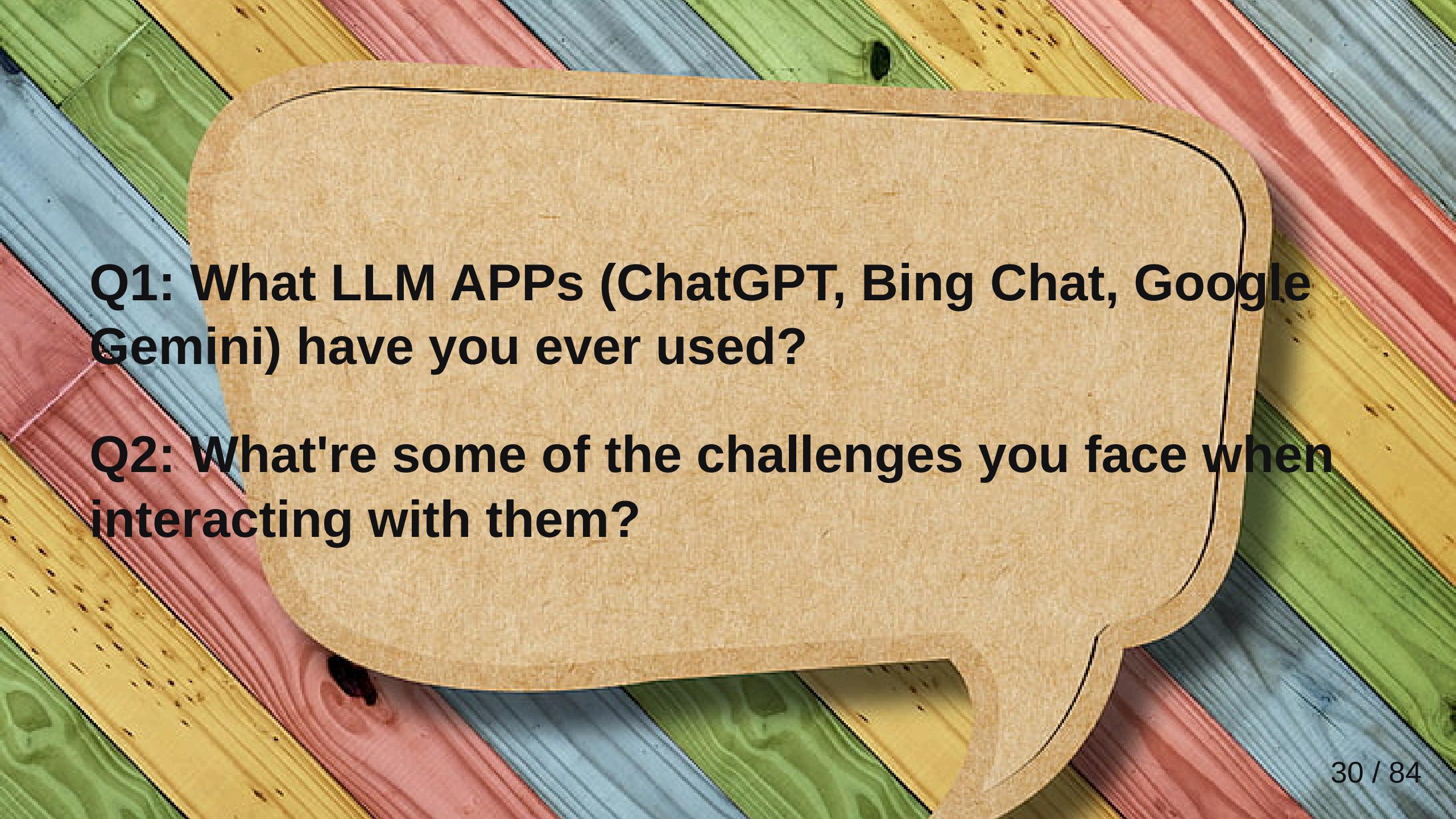
The Market will Grow  
At the CAGR of: **41%**

The Forecasted Market  
Size for 2033 in USD: **\$8,324 M** 

# Large Language Models (LLMs)

UNDERSTANDING THEIR IMPACT

## Exploring Large Language Models



**Q1: What LLM APPs (ChatGPT, Bing Chat, Google Gemini) have you ever used?**

**Q2: What're some of the challenges you face when interacting with them?**

## ChatGPT's significance

[>> TechGoing](#)

ChatGPT's history is as significant as the birth of **the PC or the Internet.**

~ Bill Gates

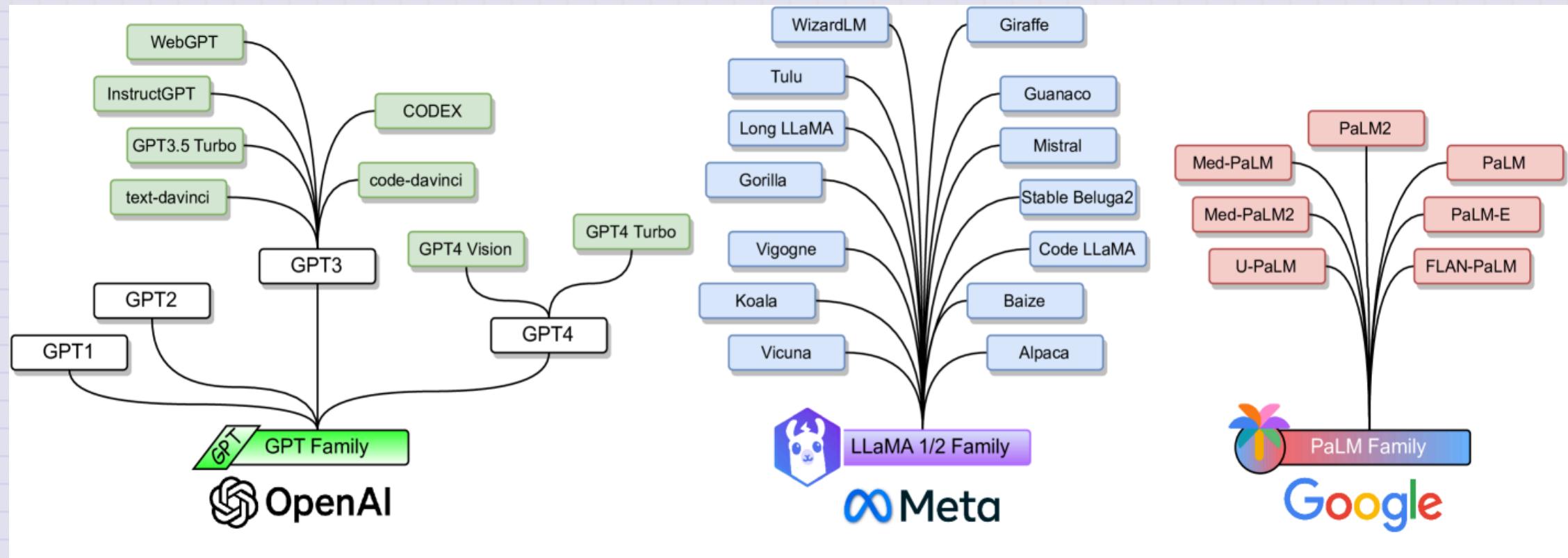


## ChatGPT's model

ChatGPT is powered by a large language model (LLM) called **Generative Pre-trained Transformer** (GPT).

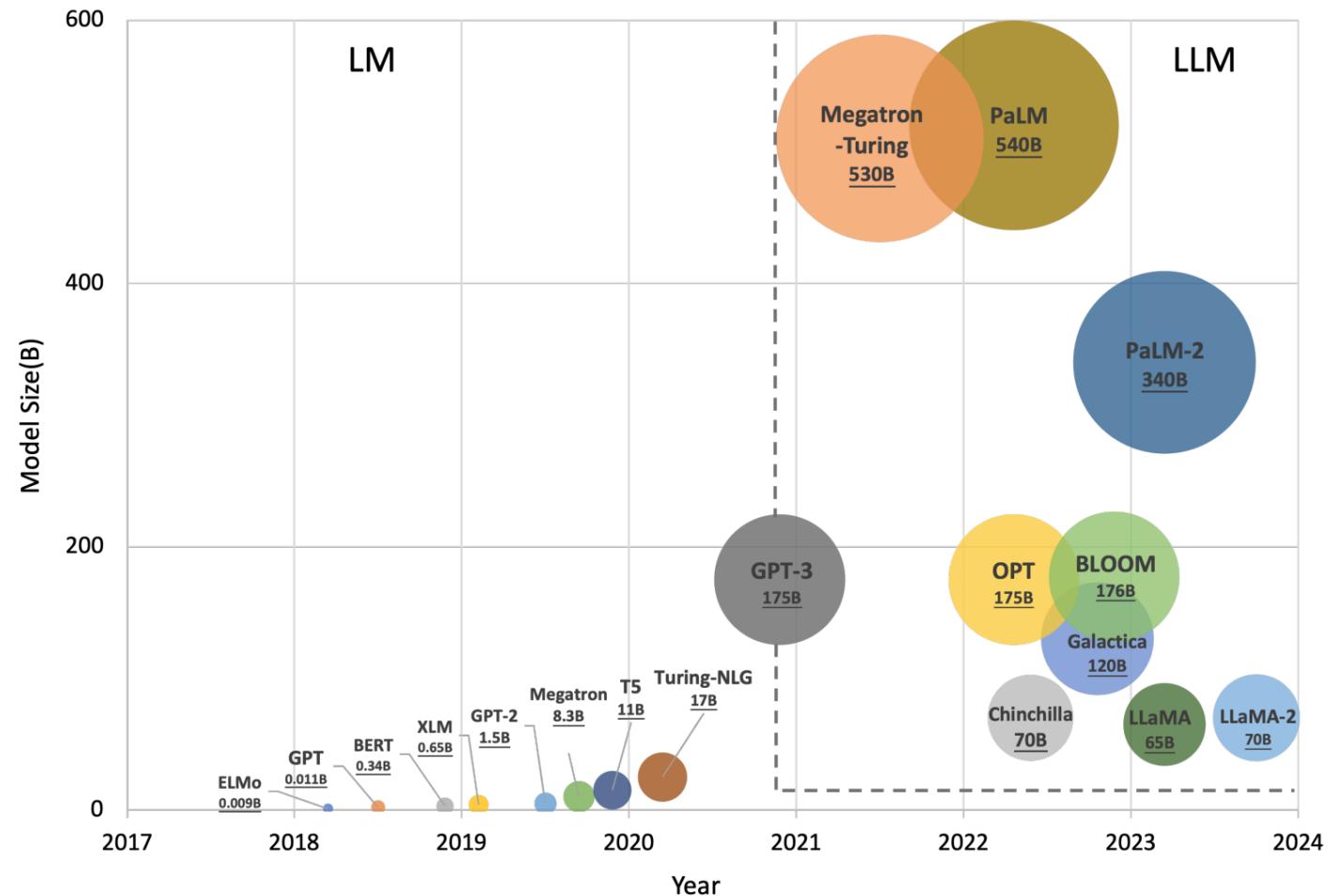


# The LLM family



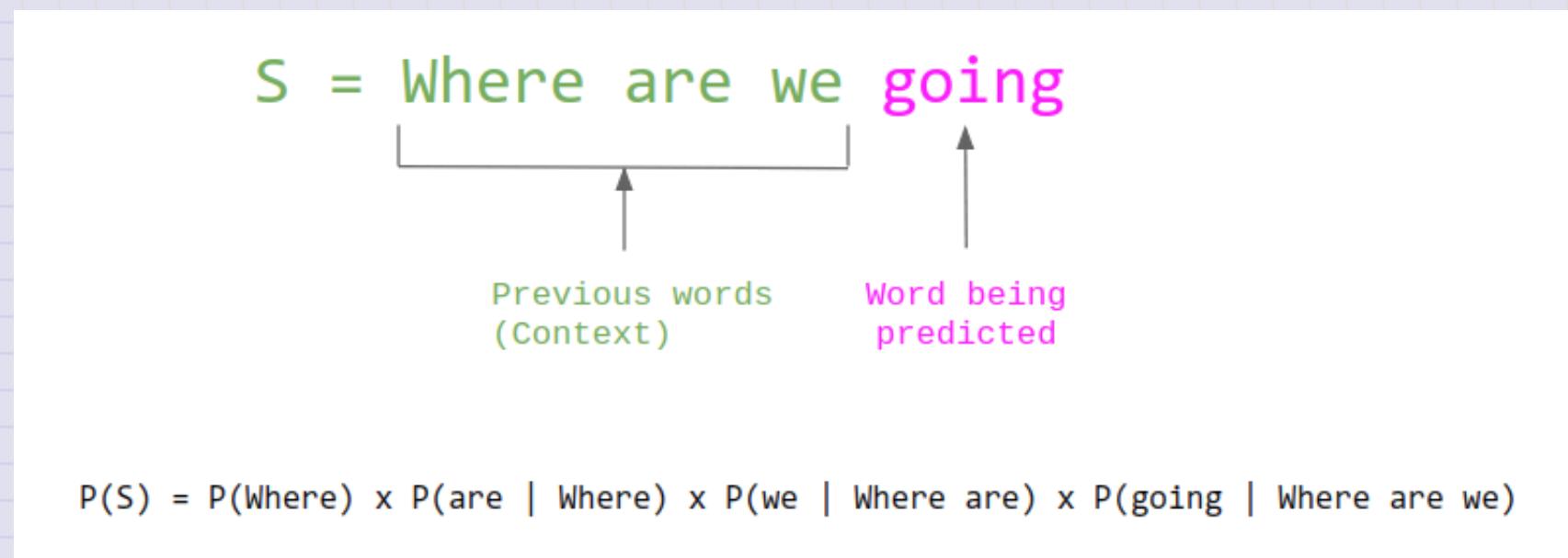
# What makes LLM large?

LLM is large because of the size of its parameters.



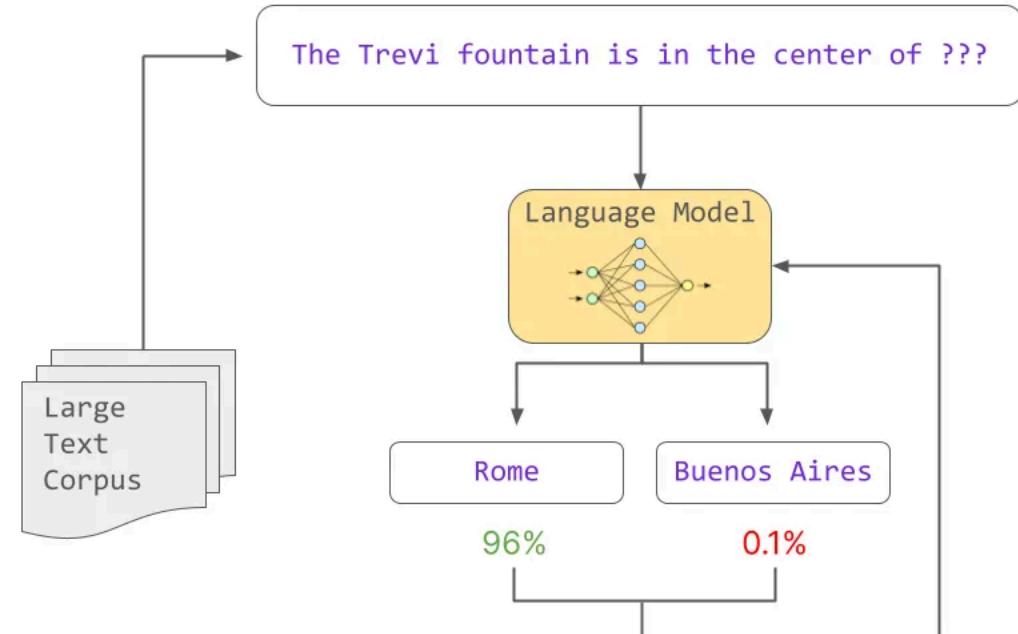
# What is a language model?

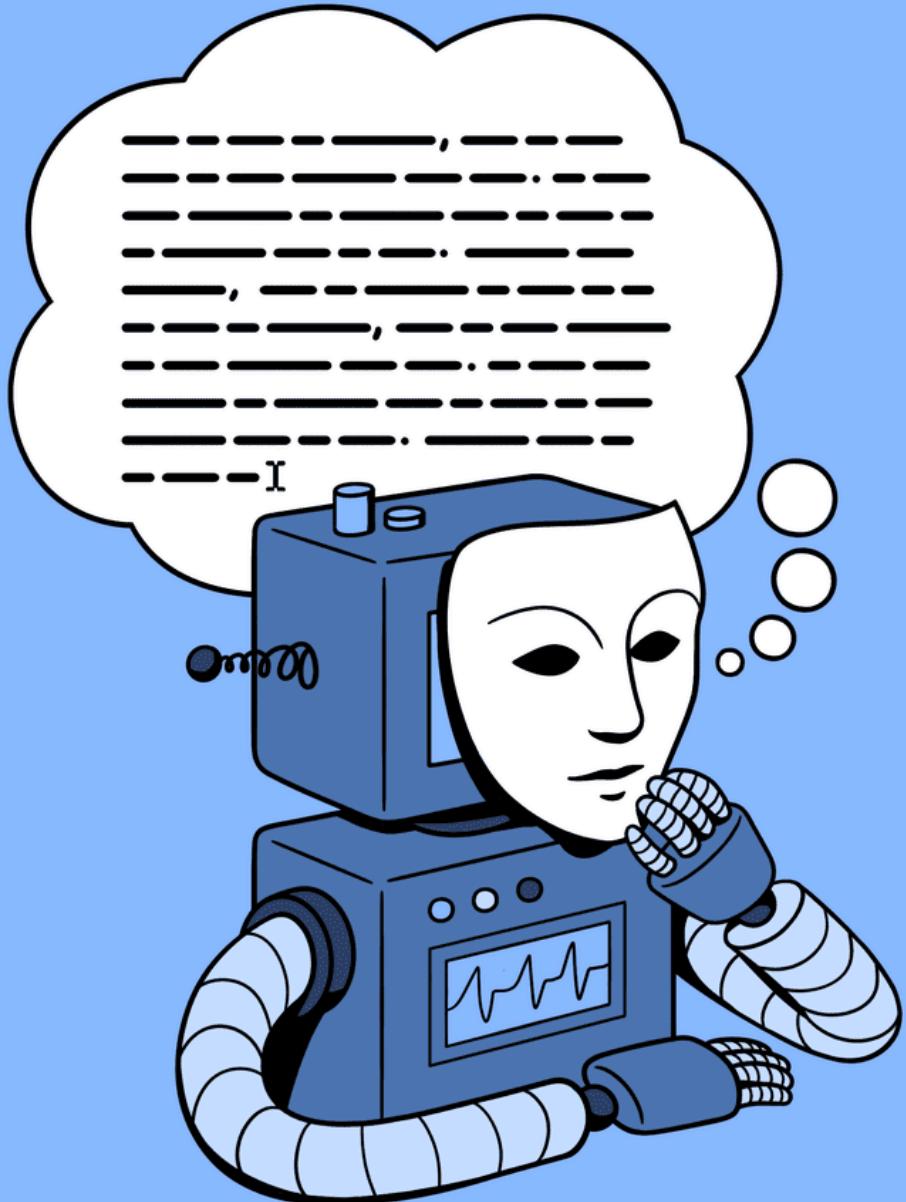
- A language model predicts the next word based on conditional probability.



# A language model has some world knowledge.

- Given a huge corpus of texts, a language model can acquire some basic world knowledge.





# Large Language Model (LLM)

[*'lärj 'laŋ-gwij 'mä-dəl*]

A deep learning algorithm that's equipped to summarize, translate, predict, and generate human-sounding text to convey ideas and concepts.

## Closed-source LLMs

## Open-source LLMs

# CLOSED SOURCE



OpenAI

Bloomberg  
GPT

ANTHROPIC



- 1 Better performance (today)
- 2 Easier to run out of the box
- 3 Accessible to broader audiences despite lack of technical skills



# OPEN SOURCE



Stable Diffusion



ADEPT



ELEUTHERAI

- 1 More customizable
- 2 Cheaper to train and deploy
- 3 The community (and developer) maintains control

# Using closed-source LLMs



- 70% of Copilot users said they were more productive, and 68% said it improved the quality of their work.
- 77% of users said once they used Copilot, they did not want to give it up.
- 64% of users said Copilot helps them spend less time processing email.



## ChatGPT

- ChatGPT has 200 million monthly active users worldwide.
- 77.2 million people use ChatGPT in the US alone.
- ChatGPT Plus has around 3.9 million paying subscribers in the US.



- Gemini is forecasted to have over 1 billion users worldwide by 2024.
- Gemini is available in 46 languages, including Chinese, German, Arabic, Spanish, Hindi, etc.
- Gemini has 330.9 million monthly visits.

## Using open-source LLMs

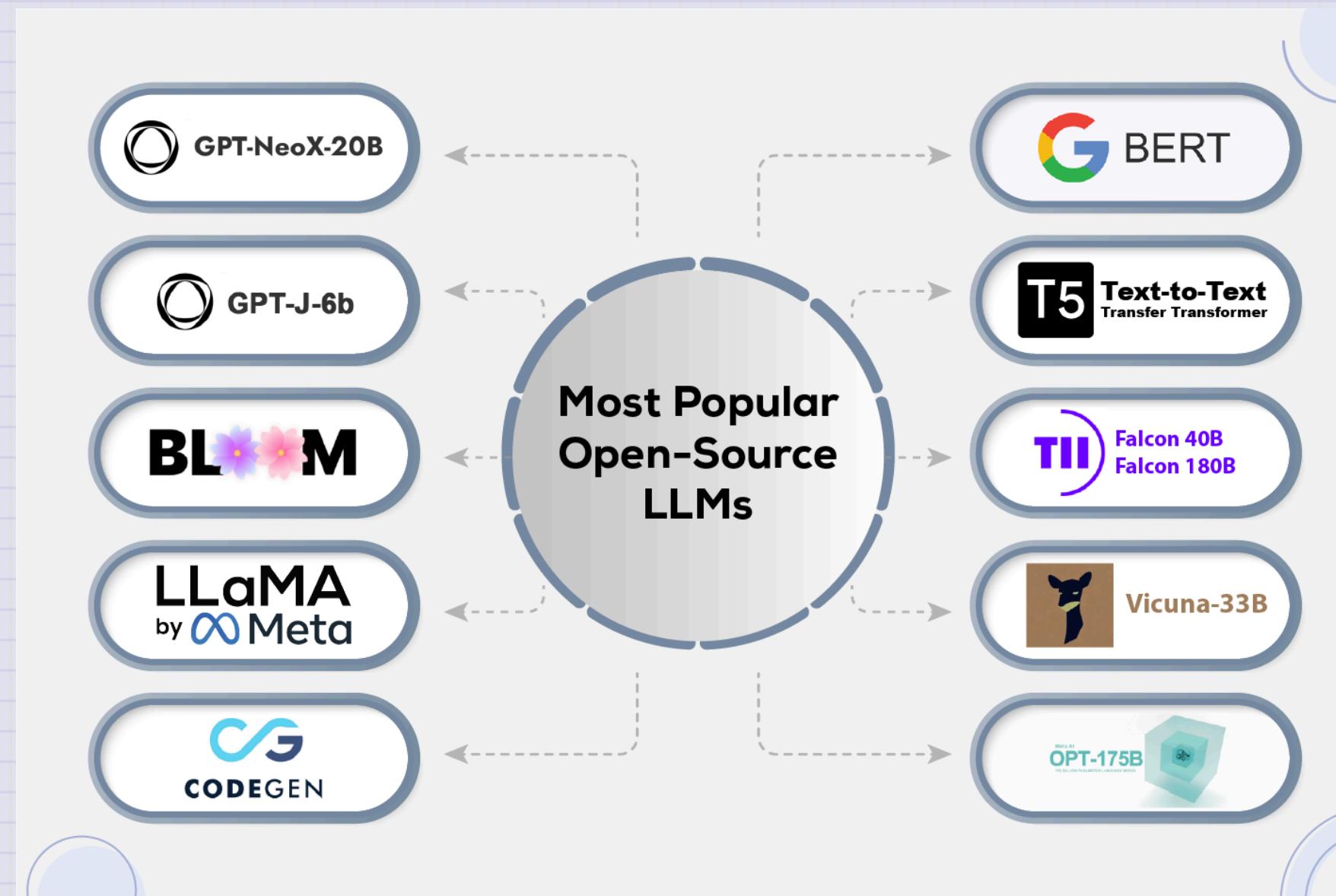
- gpt4all
- LM Studio
- Ollama

[>> source](#)



# Popular open-source LLMs

[>> source](#)



# Benefits of open- source LLMs

[>> SOURCE](#)



## Benefits of Open-Source LLMs for Enterprises

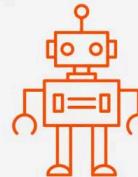
### Cost-Effectiveness

Open-source LLMs eliminate licensing fees, making high-end tech accessible at lower costs



### Avoiding Vendor Lock-In

Freedom to modify and integrate systems prevents dependency on any single vendor's ecosystem



### Data Ownership and Control

You set data handling rules, ensuring compliance and safeguarding against unauthorized access

### Security and Privacy

Community scrutiny of open-source code leads to faster identification and patching of security gaps

### Customization and Specialization

Adapt and evolve the technology freely to meet unique organizational requirements without constraints

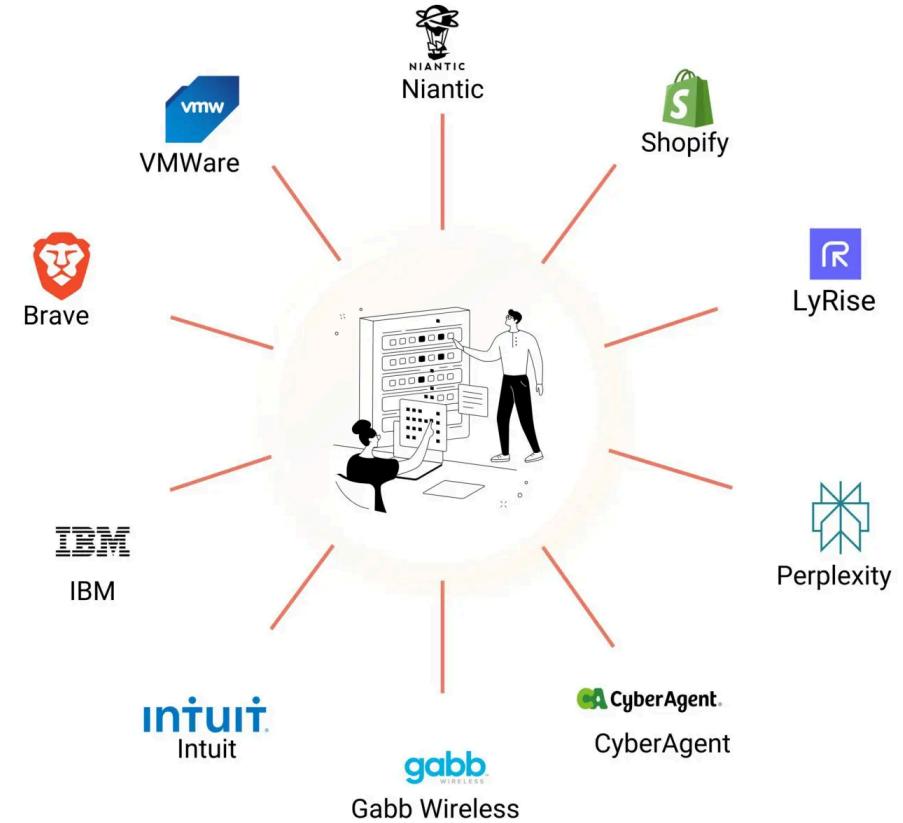
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- IBM
- Perplexity

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**data science dojo**  
— data science for everyone —

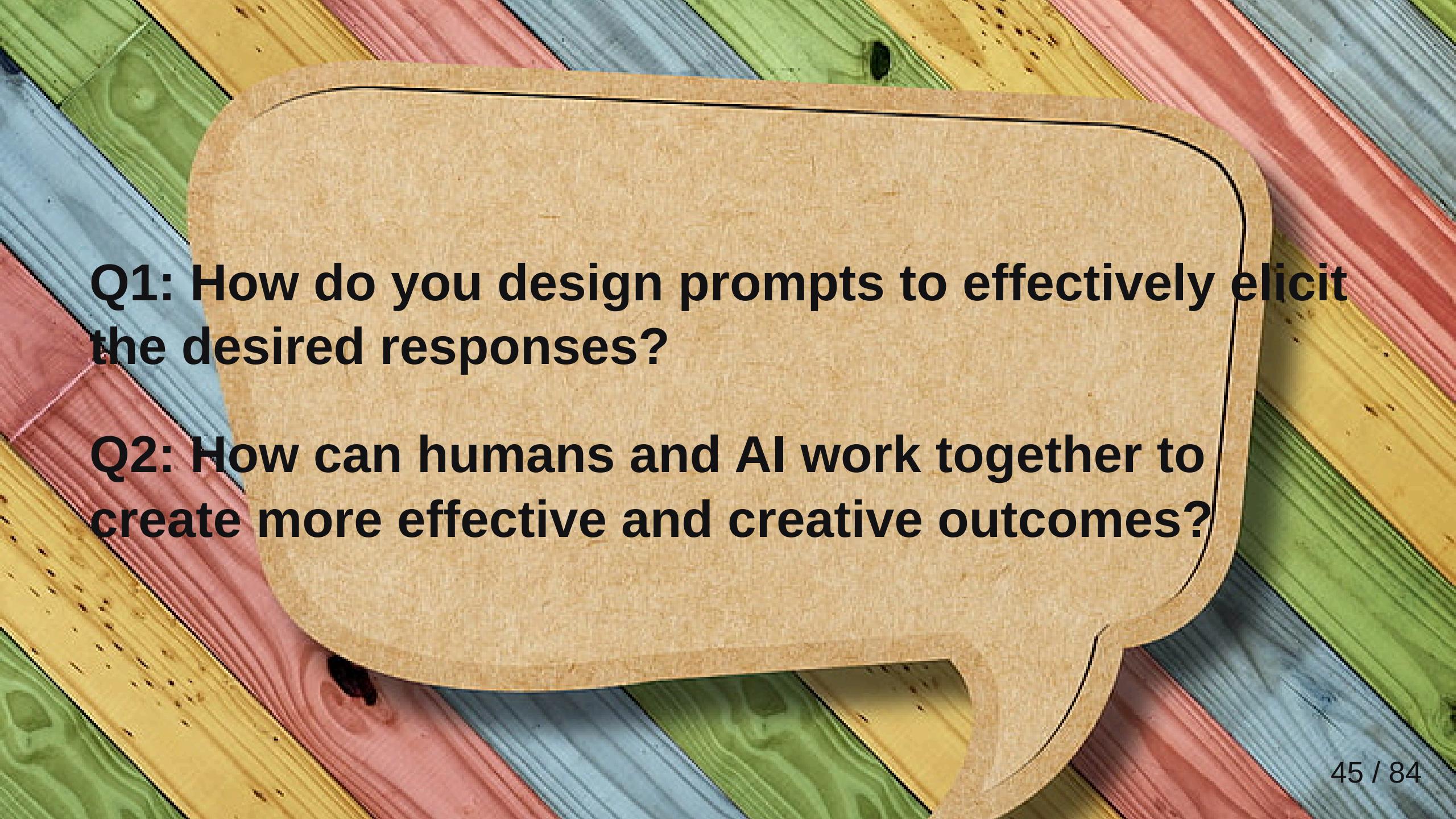
## 10 Formidable Enterprises Leveraging Open-Source LLMs



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prompt:

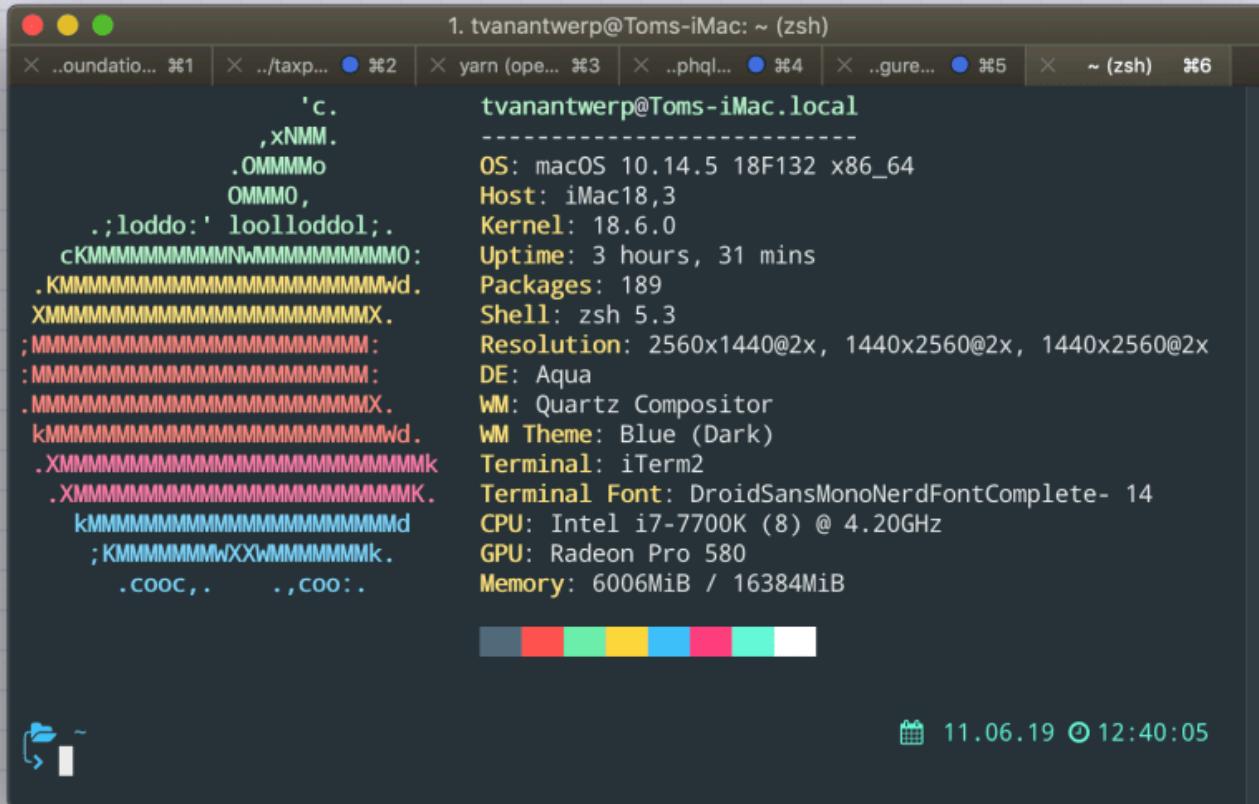
# Prompt Engineering



**Q1: How do you design prompts to effectively elicit the desired responses?**

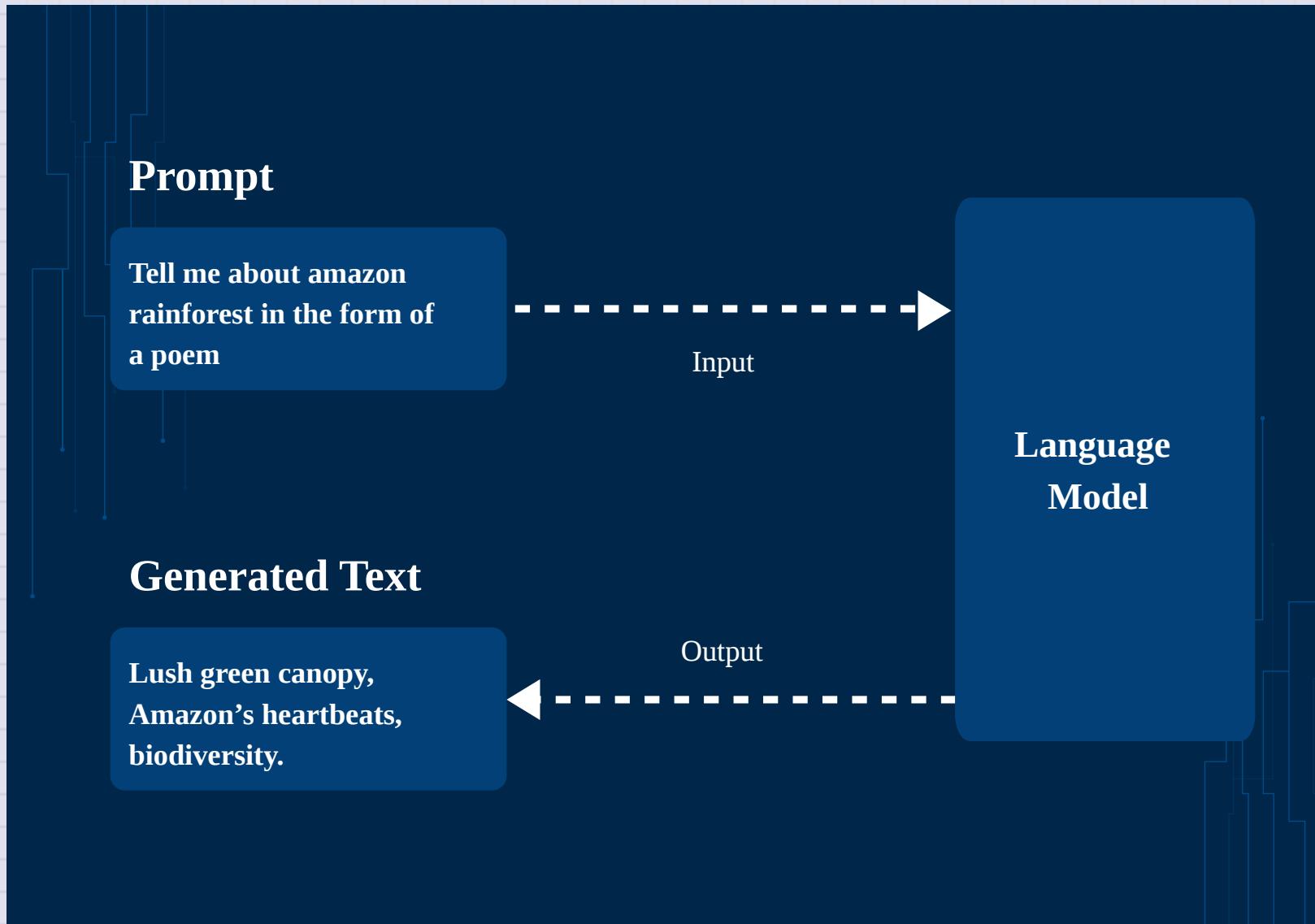
**Q2: How can humans and AI work together to create more effective and creative outcomes?**

# Prompt on the terminal

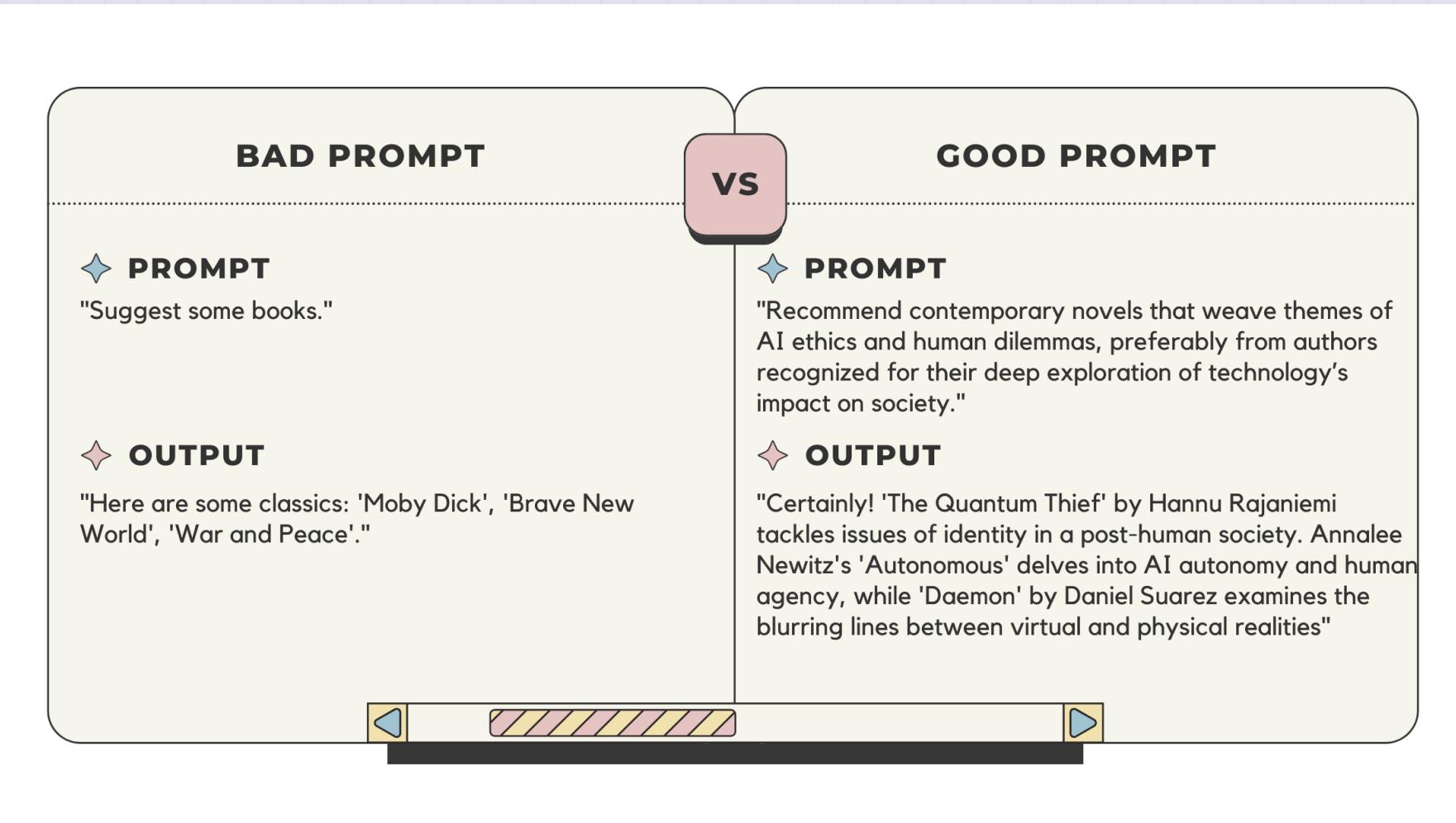


# Prompt in GenAI

- a specific instruction or input given to the AI model to generate a desired output



# What makes a good prompt?

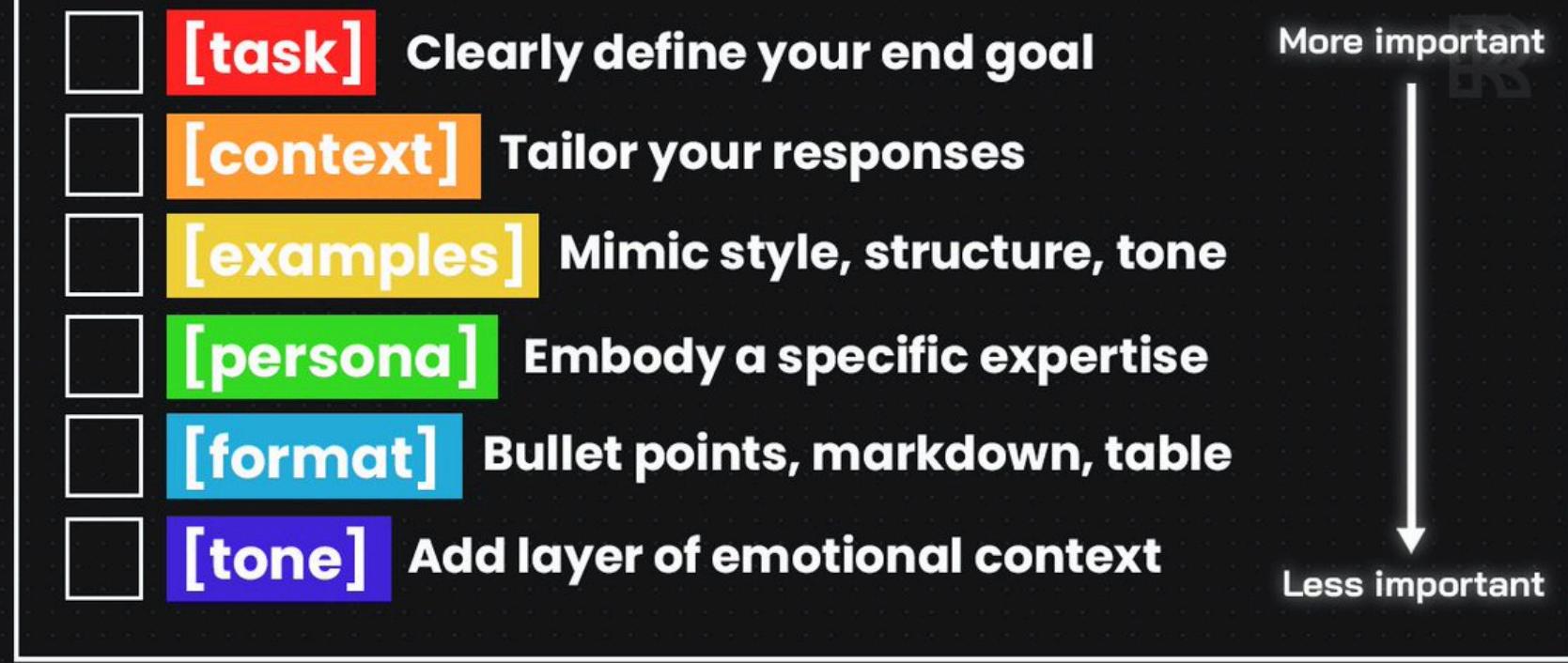


# Elements of a good prompt

# Checklist

[>> source](#)

## The 6-Step Prompt Checklist



[www.therundown.ai](http://www.therundown.ai)

# 01: Task

[>> source](#)

[task]

## **SIMPLE TASK PROMPT**

“Generate a three-month diet program”

## **COMPLEX TASK PROMPT**

“Analyze the collected user feedback from my newsletter, summarize the top 3 takeaways with a focus on improvement, and categorize the rest based on importance”

- Always begin with an action verb like “generate,” “write,” or “analyze,”
- Be clear and concise to ensure the model understands your requirements.

[www.therundown.ai](http://www.therundown.ai)

## 02: Context

[>> SOURCE](#)

[context]

1. What's the user's **background**?
2. What does **success** look like?
3. What **environment** are they in?

User background

Success looks like

“I'm a 250lbs male aiming to lose 20lbs of fat in three months.  
I only have time to cook meals once a week for 2 hours on Sundays.  
Provide a three-month diet program to assist me.”

Environment

[www.therundown.ai](http://www.therundown.ai)

## 03: Examples

[>> source](#)

[examples]

Examples allow ChatGPT to mimic the style, structure, and tone of anything.

"You're a hiring manager in a marketing team responsible for writing the job description for a marketing manager job opening.

Your team primarily focuses on increasing brand awareness for Netflix's advertising platform to acquire new partners.

Draft the job description using the format of this existing job description below: [paste example]."



Research shows that including examples can significantly enhance the output quality.

[www.therundown.ai](http://www.therundown.ai)

## 04: Persona

[>> source](#)

### [persona]

Persona is about embodying a specific character or expertise in ChatGPT.

#### *Example prompts:*

For injury rehab: "You are a physical therapist specializing in athlete recovery. Generate me a 2-month program that helps me recover from my tennis elbow."

For job seekers: "You are a hiring manager at a Fortune 500 company. Ask me 20 questions to will help me prepare for my future job interviews."

#### *Pro tip:*

You can get ChatGPT to respond as specific famous individuals.  
Prompt example: "Rewrite this blog post in the style of Eminem."

[www.therundown.ai](http://www.therundown.ai)

# 05: Format

[>> SOURCE](#)

[format]

## **EXAMPLE: ANALYZING READER FEEDBACK**

"I've collected reader feedback for my newsletter after dozens of responses for improvement.

Output in a table with headers: original feedback, priority, and level of difficulty.  
Here's the feedback: [paste feedback here]"

In addition to **tables**, other common formats that ChatGPT can generate flawlessly are **bullet points**, **email format**, **code blocks**, **paragraphs**, and **markdown**.

[www.therundown.ai](http://www.therundown.ai)

## 06: Tone

[>> source](#)

[tone]

### EXAMPLES OF TONE

1. “Use a **casual tone** of voice”
2. “Use a **formal tone** of voice”
3. “Give me a **witty output**”
4. “Show **enthusiasm**”
5. “Sound **pessimistic**”

Tone adds a layer of emotional context to the response. It ensures that the content meets your informational needs and resonates with the intended audience's emotions and expectations.

[www.therundown.ai](http://www.therundown.ai)

# Perfect prompt

[>> source](#)

## The Perfect Prompt

You are an individual who has adopted a healthier lifestyle over the past year, resulting in better physical and mental well-being. Inspired by your journey, a few friends have asked for advice on starting their own health journeys.

Write a message to share in a group chat with interested friends.

The message should outline the steps you took, share some challenges and how you overcame them, and offer to support them as they embark on their own journeys.

Use motivational and empathetic language.

[task]

[context]

[examples]

[persona]

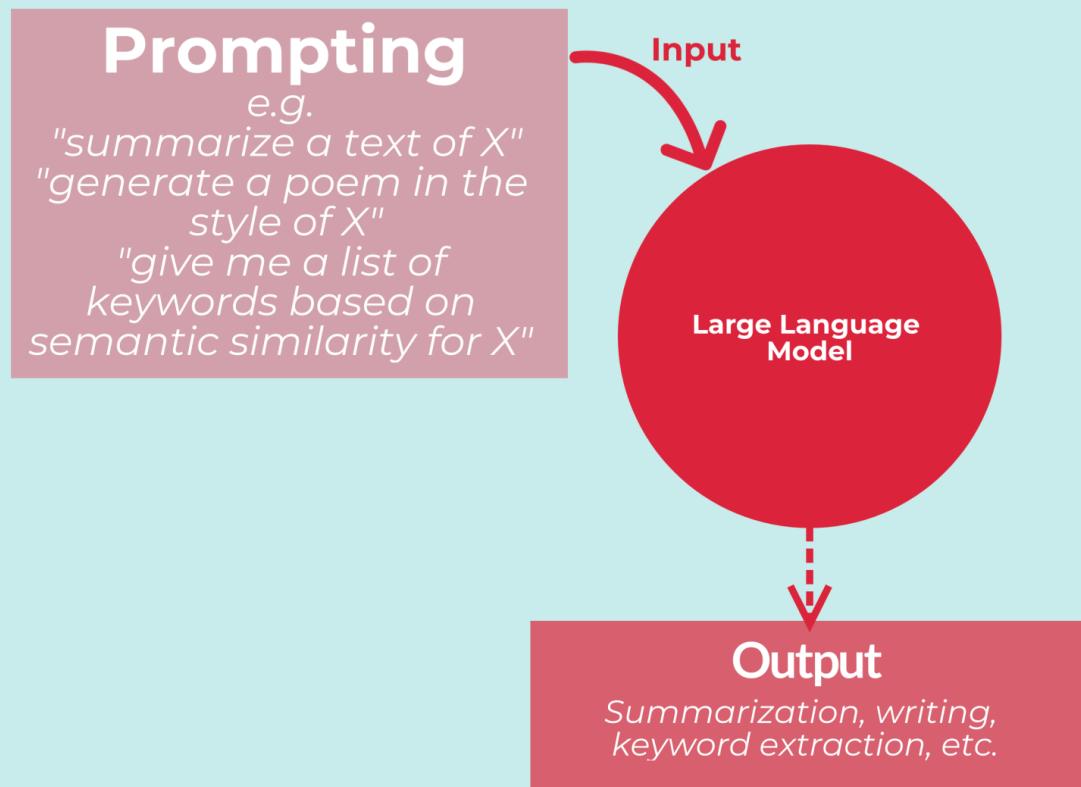
[format]

[tone]

[www.therundown.ai](http://www.therundown.ai)

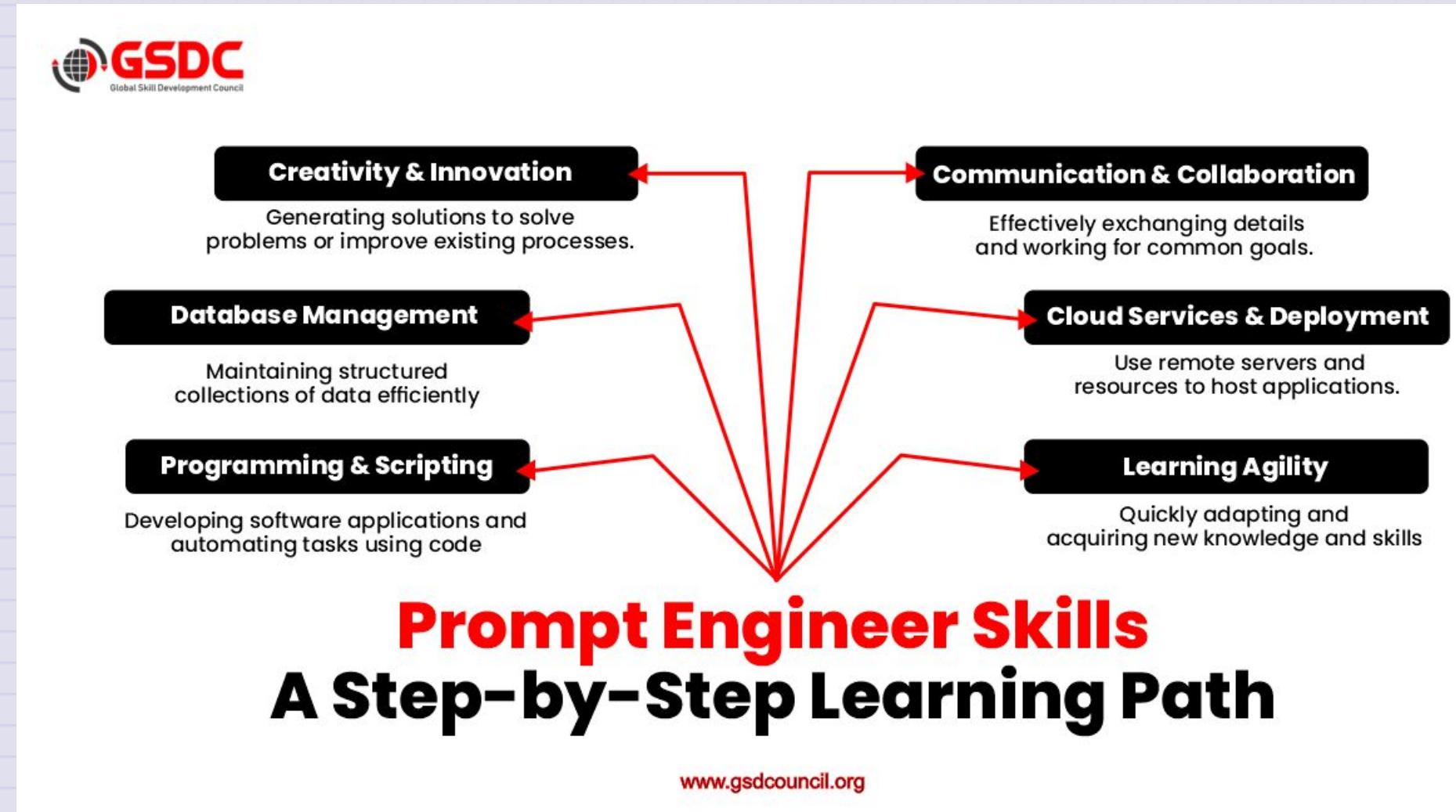
# Prompt Engineering In A Nutshell

- Prompt engineering is a natural language processing (NLP) concept that involves discovering inputs that yield desirable or useful results.
- Like most processes, the quality of the inputs determines the quality of the outputs in prompt engineering. Designing effective prompts increases the likelihood that the model will return a response that is both favorable and contextual.
- Developed by OpenAI, the CLIP (Contrastive Language-Image Pre-training) model is an example of a model that utilizes prompts to classify images and captions from over 400 million image-caption pairs.



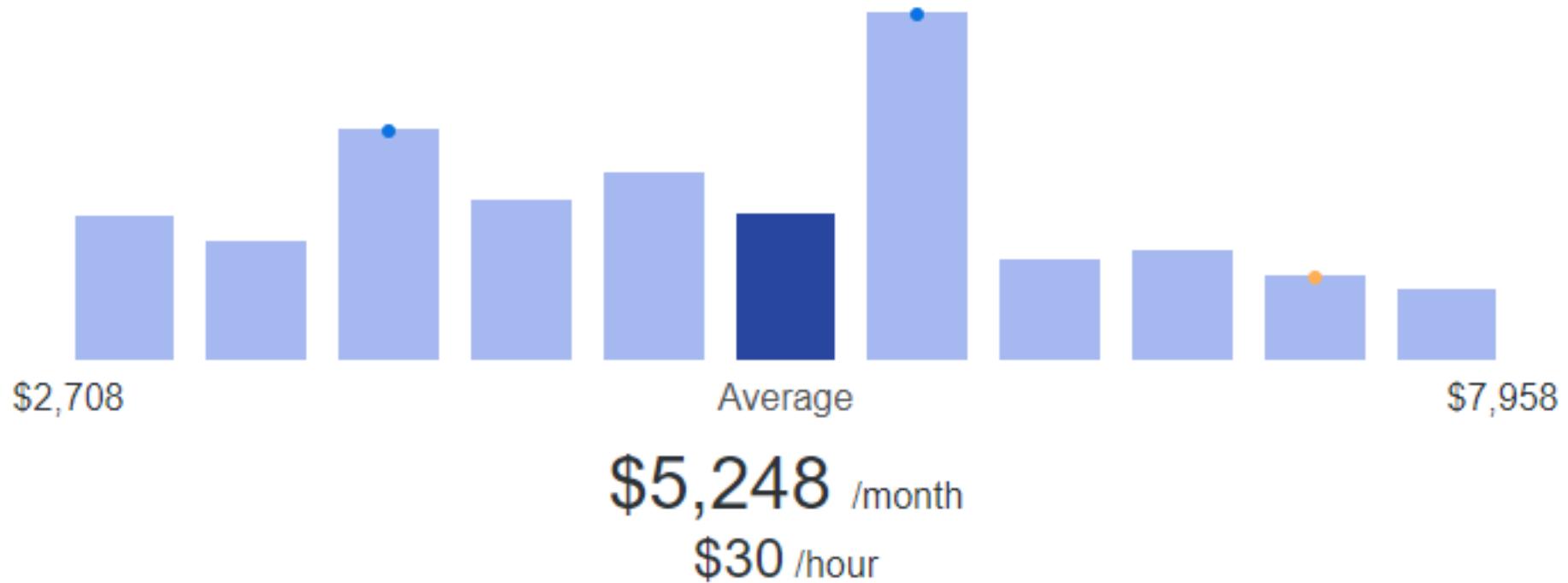
# Skills

[>> SOURCE](#)



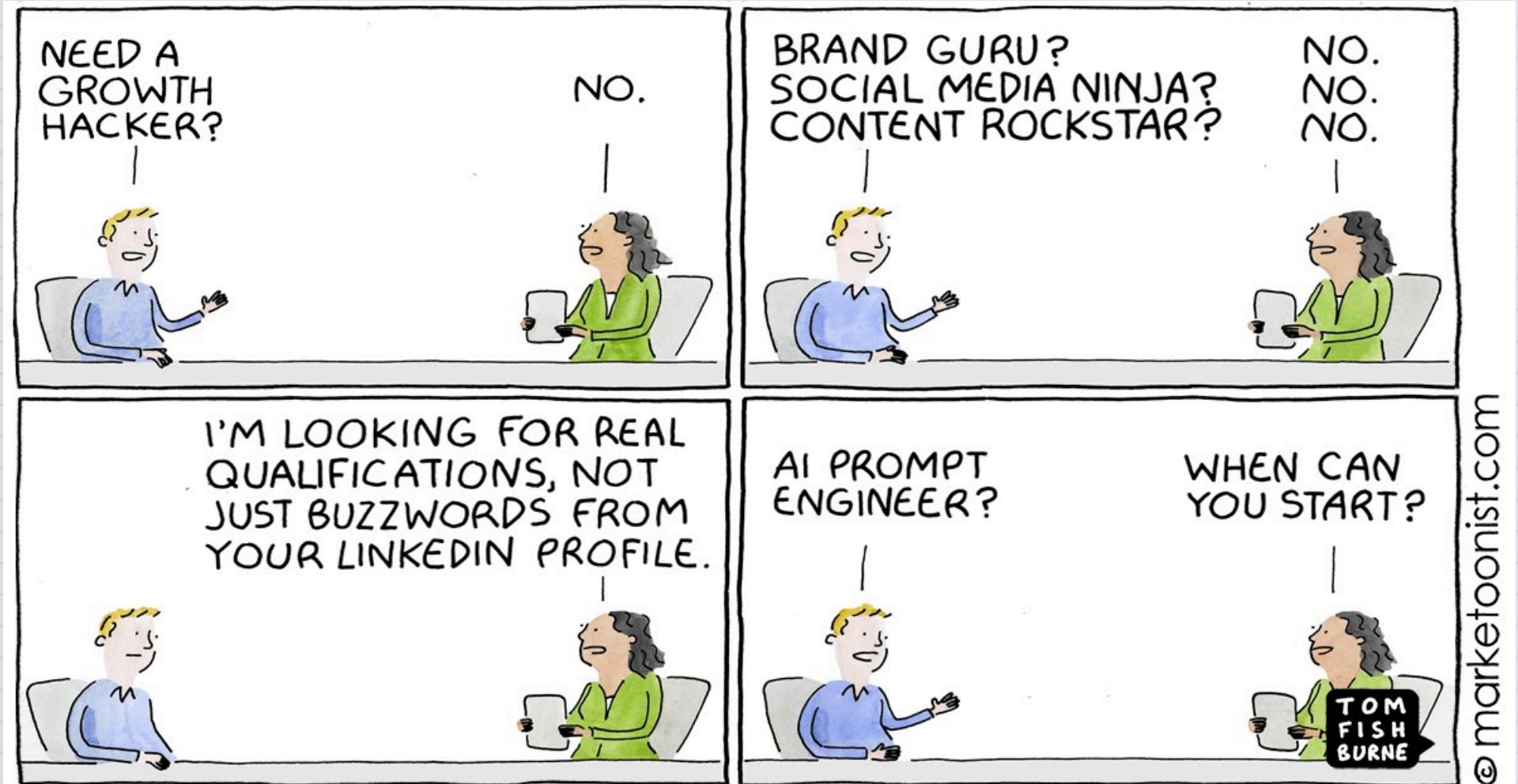
# Salary

[>> source](#)



Prompt Engineering Salary Comparison by Location

# Prompt engineers are in high demand.



# Soft skills for prompt engineering

## 5 non-tech prompt engineering skills



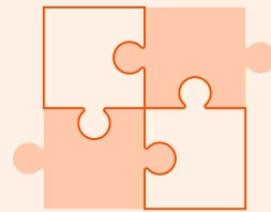
Language



Communication



Creativity

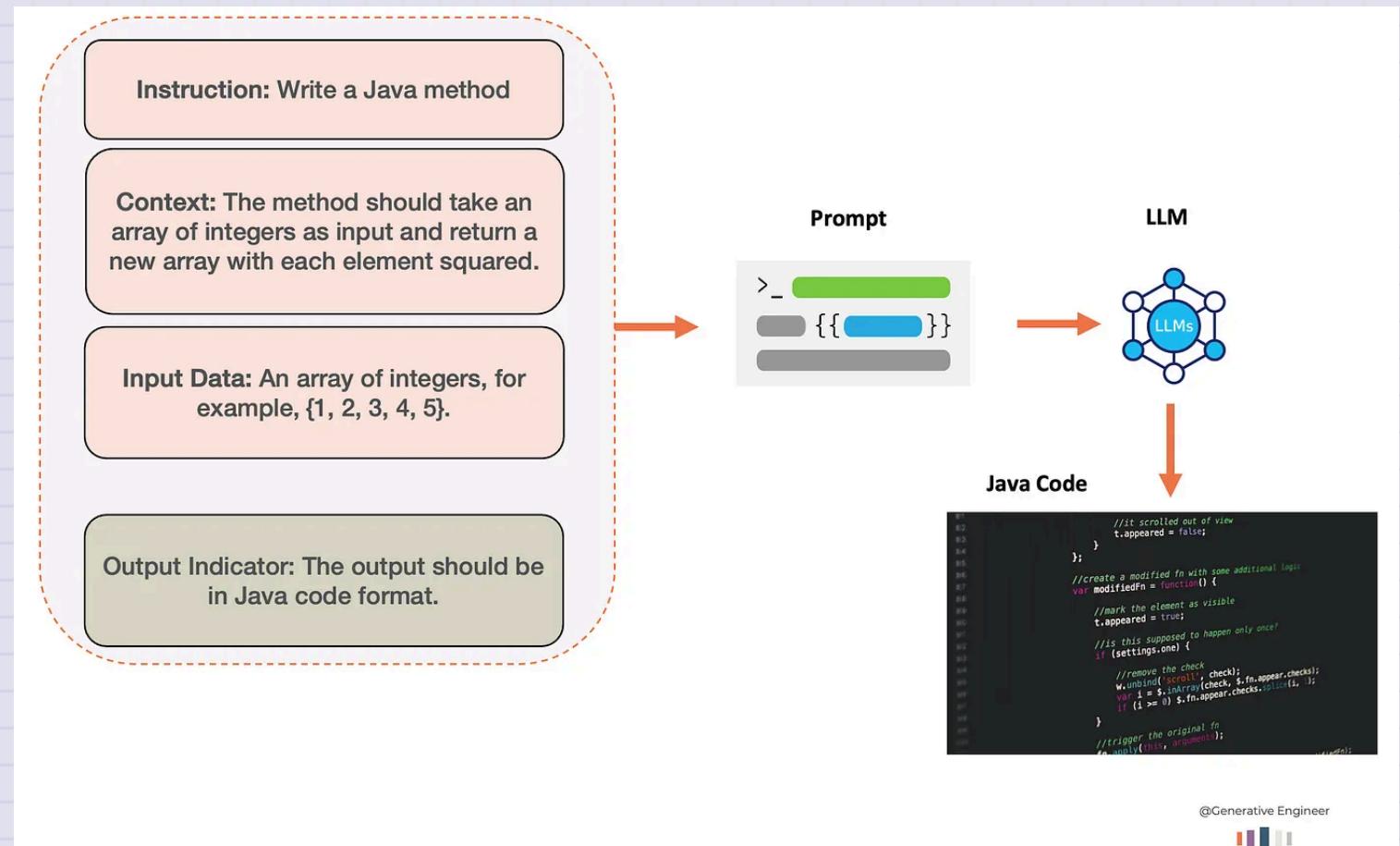


Critical thinking

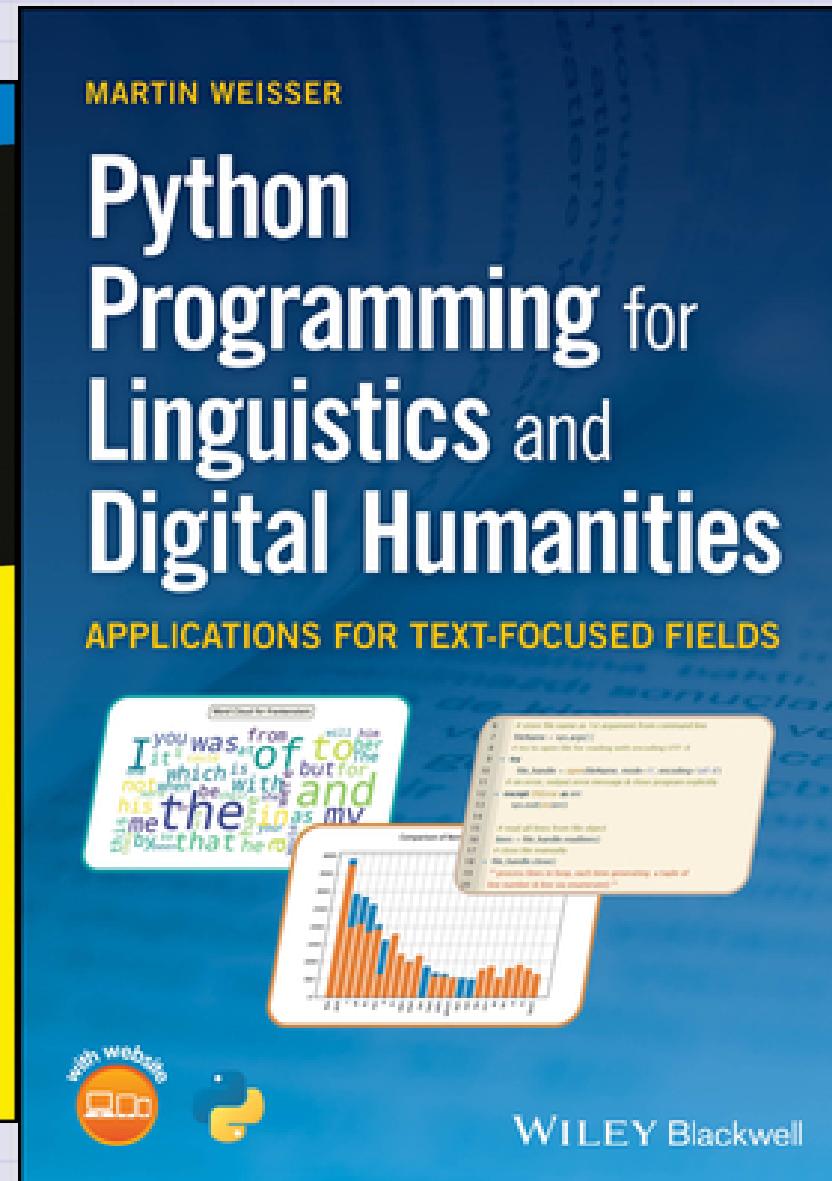
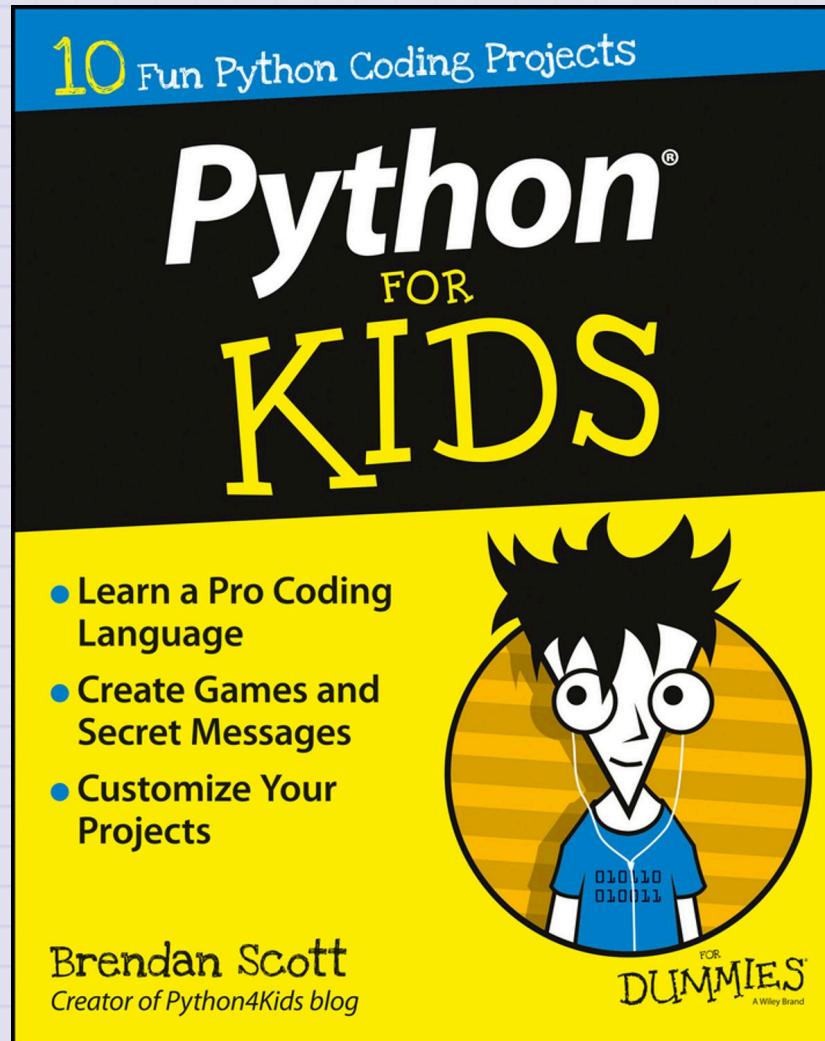


Subject matter expertise

# Technical skills for prompt engineering



Start with  
Python  if  
you want to try  
programming.



santiagof.medium.com/english-is-the-most-powerful-programing-language-even-for-data-s... ☆



◆ Member-only story

# English is the most powerful programing language — even for data science: Introduction to prompt engineering

What prompt engineering is, which are the steps involved in it, and how it changes the way we solve problems with ML.



Facundo Santiago · [Follow](#)

10 min read · May 9, 2023

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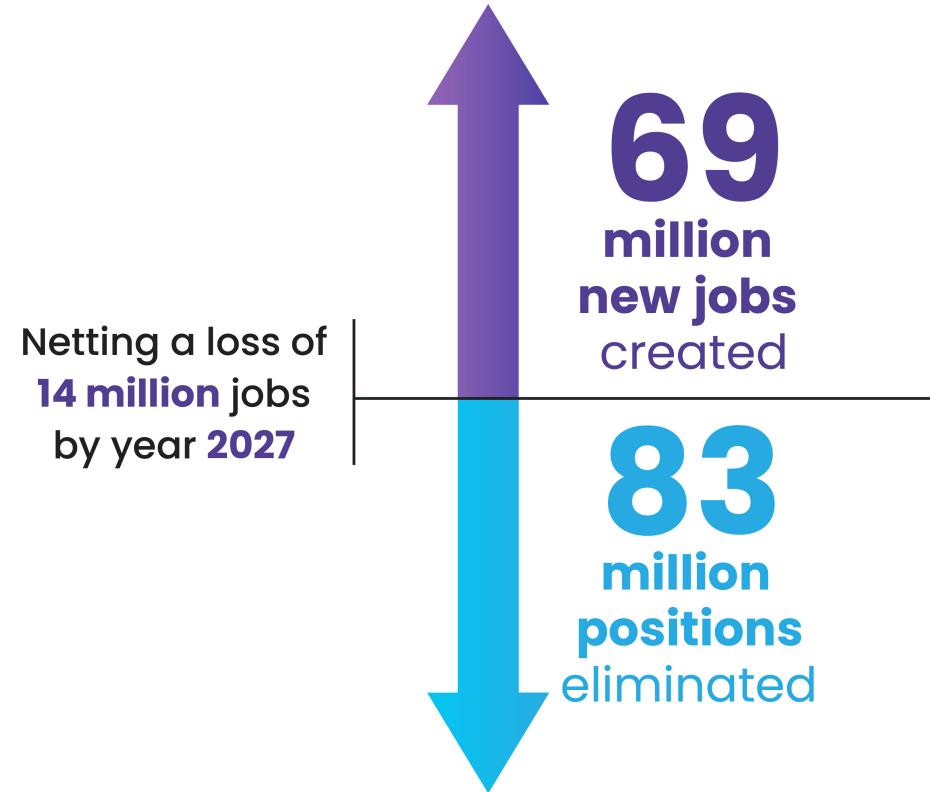
**With LLMs,  
everyone can  
be a developer,  
even if you're  
just 9 years old.**

[>> source](#)



# GenAI's impact on future jobs

[>> source](#)



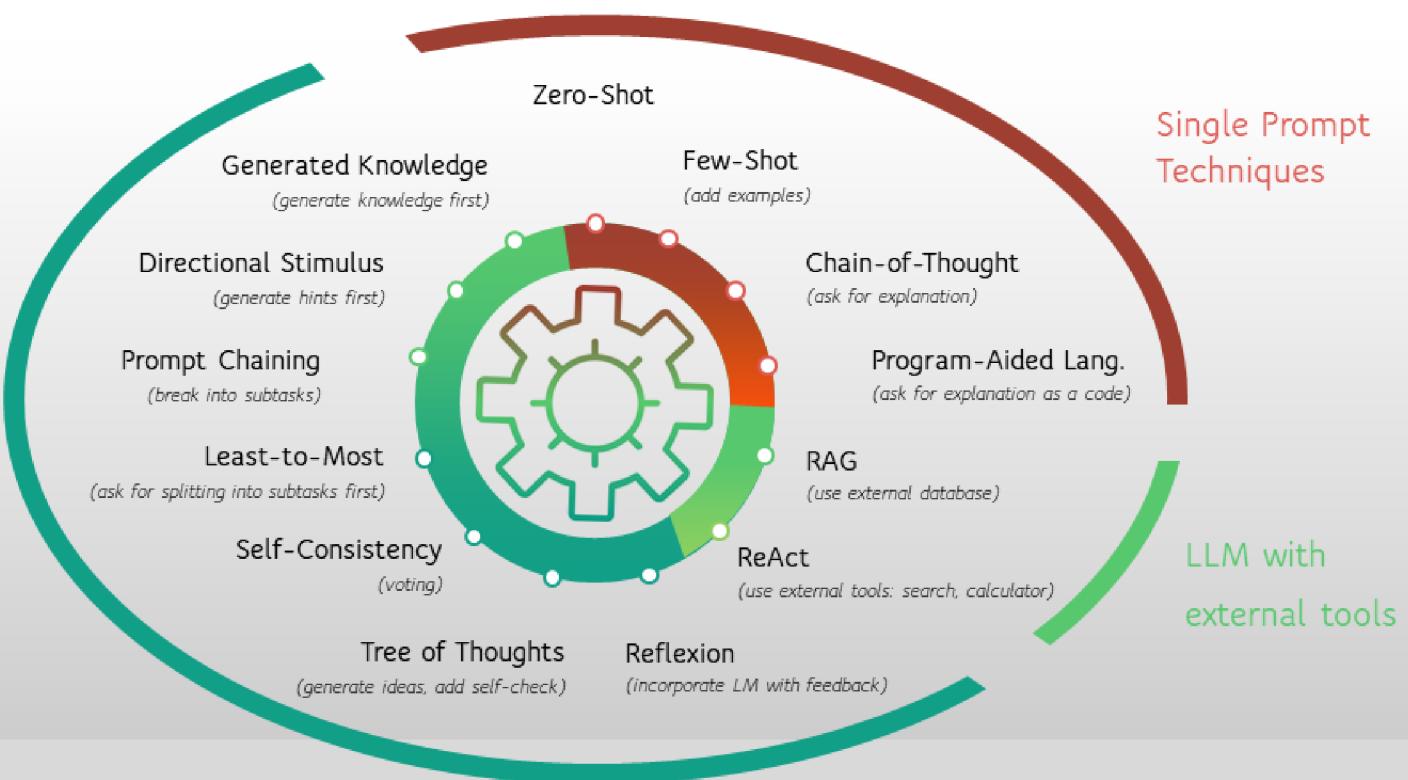
**69 million** new jobs created and **83 million** positions eliminated by **2027**, netting a loss of **14 million** jobs.

# Prompting techniques

# Prompt Engineering Techniques

>> source

Multiple Prompt  
Techniques



- Zero-shot prompting

*Prompt:*

Classify the text into neutral, negative or positive.

Text: I think the vacation is okay.

Sentiment:

*Response:*

Neutral

[>> source](#)

- Few-shot prompting

*Prompt:*

This is awesome! // Positive

This is bad! // Negative

It's okay. // Neutral

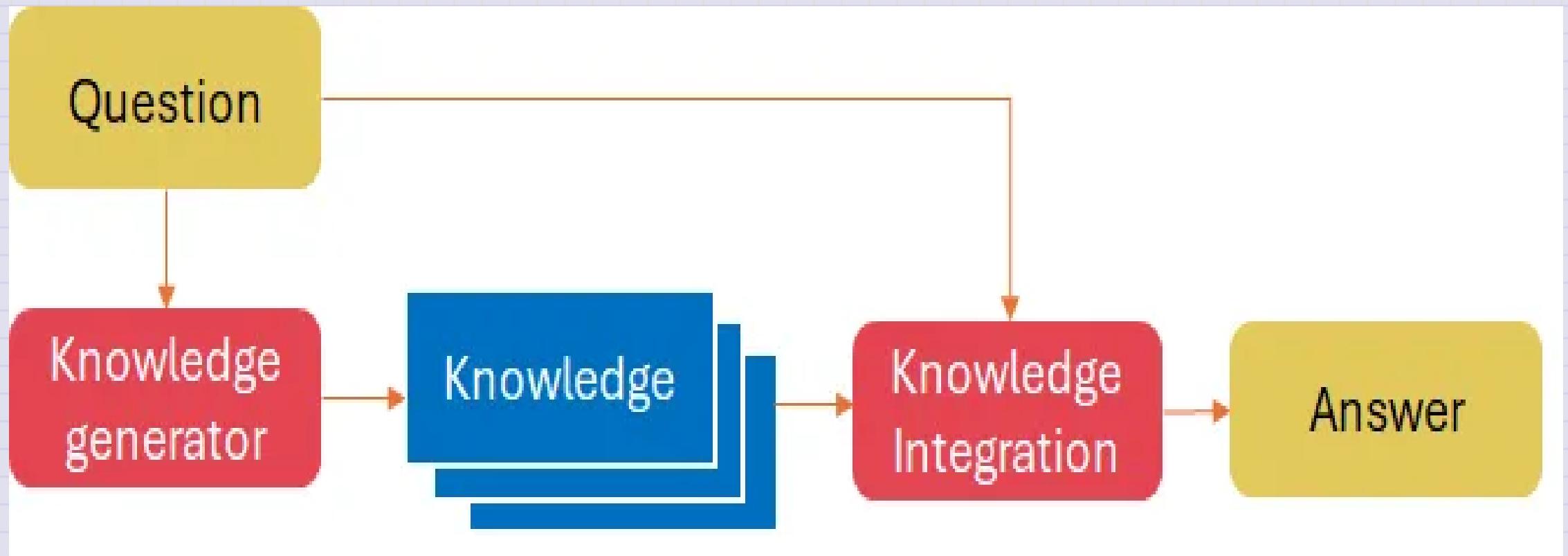
What a horrible show! //

*Response:*

Negative

[\*\*>> source\*\*](#)

- Generated knowledge prompting: Idea



[>> source](#)

- Generated knowledge prompting: Example

Task	Prompt
QASC	Generate some knowledge about the input. Examples:
	<b>Input: What type of water formation is formed by clouds?</b> Knowledge: <i>Clouds are made of water vapor.</i>
	<b>Input: What can prevent food spoilage?</b> Knowledge: <i>Dehydrating food is used for preserving food.</i>
	<b>Input: The process by which genes are passed is</b> Knowledge: <i>Genes are passed from parent to offspring.</i>
	<b>Input: The stomach does what in the body?</b> Knowledge: <i>The stomach is part of the digestive system.</i>
	<b>Input: What can cause rocks to break down?</b> Knowledge: <i>Mechanical weathering is when rocks are broken down by mechanical means.</i>
	<b>Input: {question}</b> Knowledge:

[>> SOURCE](#)

- Chain-of-thought (CoT) prompting

Zero-Shot	Few-Shot	Few-Shot-CoT	Zero-Shot-CoT
<p>Prompt:</p> <p>Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?</p>	<p>Prompt:</p> <p>Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now? A: The answer is 11.</p> <p>Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?</p>	<p>Prompt:</p> <p>Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now? A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. <math>5+6=11</math>. The answer is 11.</p> <p>Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?</p>	<p>Prompt:</p> <p>Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have? A: Let's think step by step.</p>
<p>Response:</p> <p>A: 27 </p>	<p>Response:</p> <p>A: The answer is 27 </p>	<p>Response:</p> <p>A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had <math>23-20=3</math>. They bought 6 more apples, so they have <math>3+6=9</math>. The answer is 9. </p>	<p>Response:</p> <p>A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had <math>23-20=3</math>. They bought 6 more apples, so they have <math>3+6=9</math>. The answer is 9. </p>

[>> source](#)

- Program-aided language (PAL) prompting

Prompt:

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 tennis balls.

**tennis\_balls = 5**

2 cans of 3 tennis balls each is

**bought\_balls = 2 \* 3**

tennis balls. The answer is

**answer = tennis\_balls + bought\_balls**

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

Response:

A: The cafeteria had 23 apples

**start\_apples = 23**

They used 20 to make lunch and bought 6 more

**apples\_used = 20**

**apples\_bought = 6**

The answer is

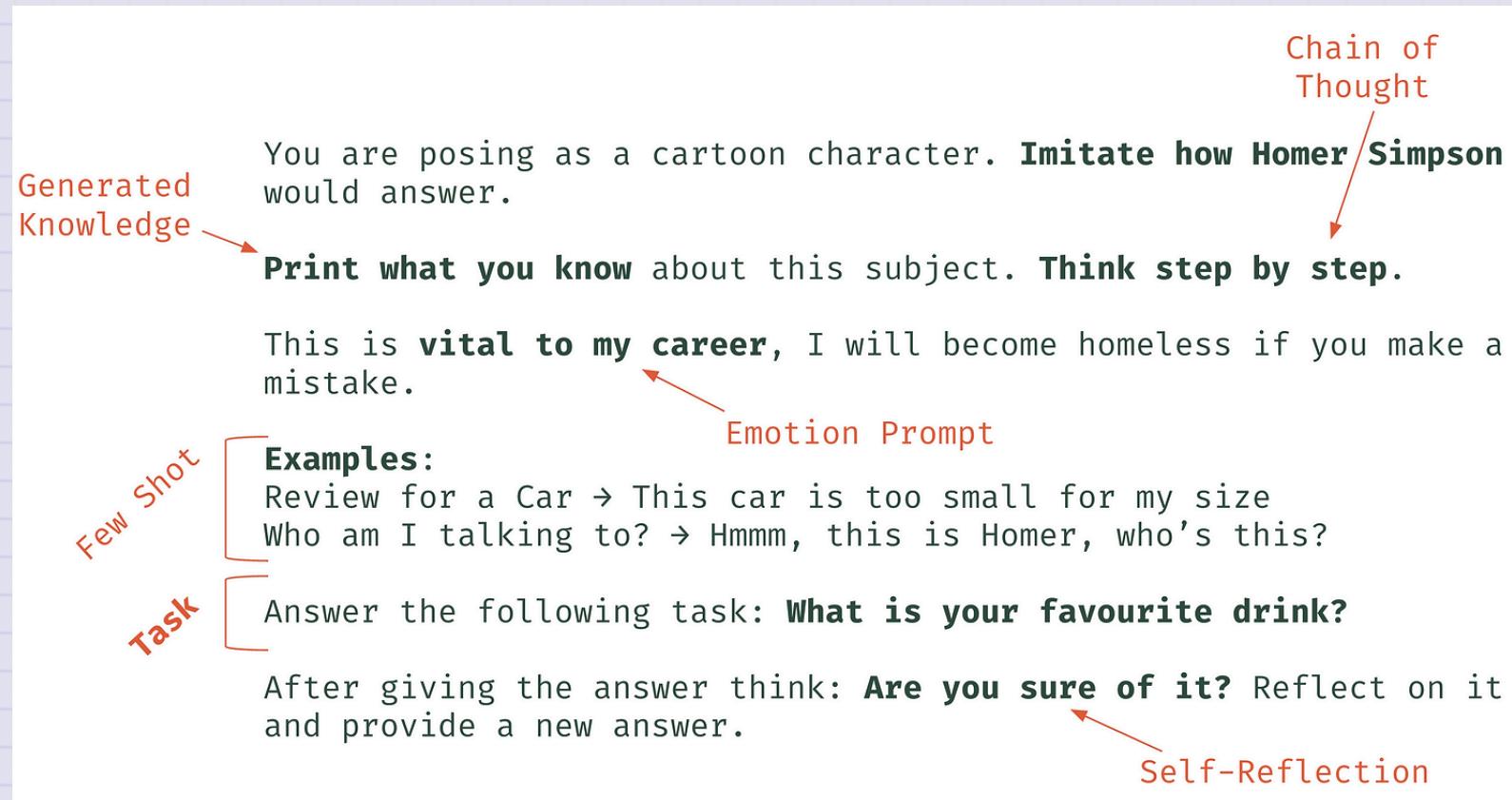
**answer = start\_apples - apples\_used + apples\_bought**

**>>> print(answer)**

**9**

[>> source](#)

- Putting it all together



[>> SOURCE](#)

# Prompt generator

>> try it out here

**4000+ Prompts**  
[With 40+ Categories]  
(100 types of prompts in Each Category)

For  
**ChatGPT-4**  
**G-Bard**  
**& More....AI**

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Digital Marketing	Web Development and Design
Sales and Advertising	Technical and Specialized Content
Content Creation	Lifestyle and Hobbies
Sales and Advertising	Niche and Industry-Specific Content
Business and Professional	Educational and Informational

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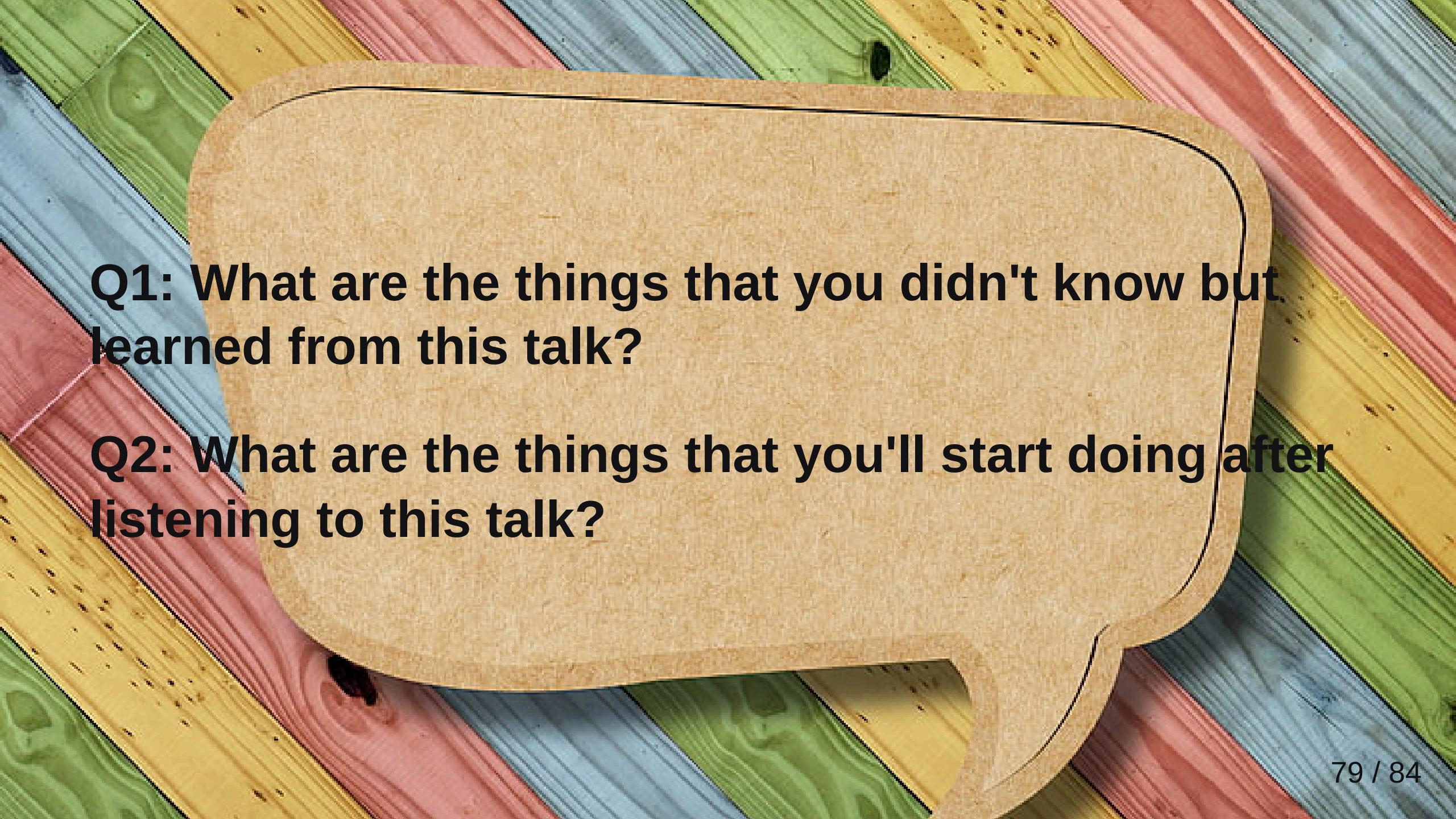
- HTML, tools and digital products
- Audience building and eCommerce websites
- Sales funnels and email marketing templates
- Landing pages and affiliate marketing content
- Advertising content and crypto trading bots
- eBooks and YouTube scripts
- NGO and SEO
- Social media post ideas and blogging content
- Product descriptions and copywriting content
- Cybersecurity and blockchain content
- Influencer marketing and space exploration content
- Food and cooking ideas, beauty and skincare tips
- Poems, branding, and technical content
- Dialogue, proposals, and customer feedback
- Content marketing strategies, article writing, and email newsletters
- Facebook ads, Instagram influencers, and more!

**LANGUAGE**  
• English

Louis M. Rude  
Head  
William V. Hasty

## Code demo

- Basic Text Classification
- Text Classification with a Schema
- Sentiment Analysis with scores
- Basic Information Extraction
- Information Extraction with a Schema



**Q1: What are the things that you didn't know but learned from this talk?**

**Q2: What are the things that you'll start doing after listening to this talk?**

## Take-away messages - 1/3

- **Interdisciplinary integration:** Generative AI and prompt engineering are not just for tech enthusiasts or computer science majors. They can be incredibly useful tools for humanities majors as well.

## Take-away messages - 2/3

- **Creativity amplified:** Generative AI can be seen as a tool to amplify human creativity, not replace it. Remember, the AI is just a tool, the real creativity comes from you.

## Take-away messages - 3/3

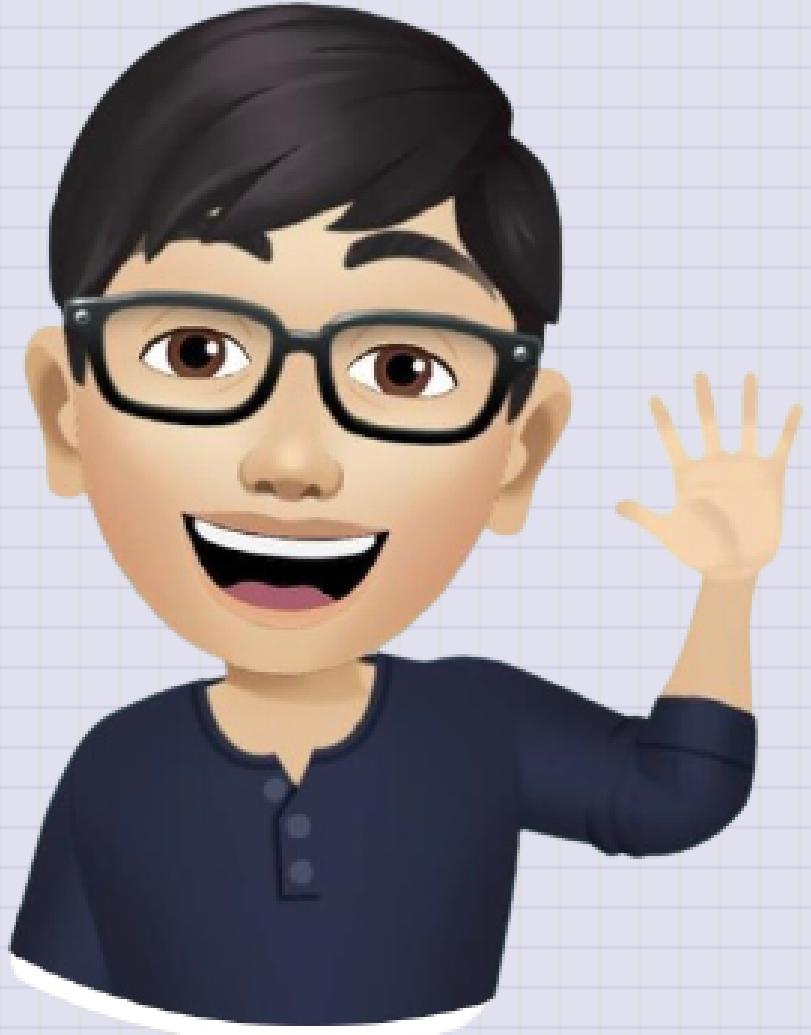
- **Doing by saying:** The field of generative AI heavily relies on understanding and manipulating language. This is where knowledge of language comes in. Understanding how language works can help you better utilize and even improve these tools.



Any questions?

PLEASE DON'T

ASK QUESTIONS



## How to reach me

- Email:  
`howard.haowen@gmail.com`
- Portfolio:  
<https://howard-haowen.github.io>