



# AI, Prompt Engineering & Linguistics

Speaker: Dr. [Haowen Jiang](#)

Date: Sep 12th, 2024

# Outline

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

# My background



# Education



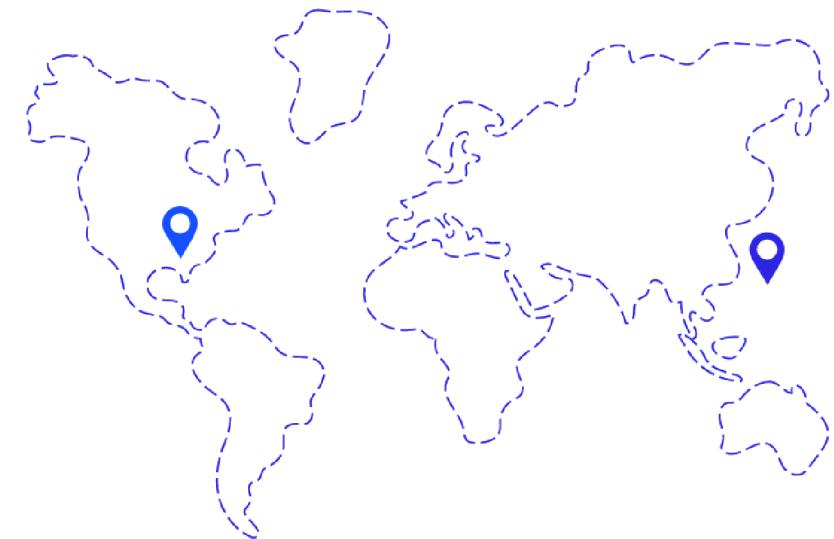
## Nat'l Taiwan University

MA, Linguistics  
BA, Foreign Languages



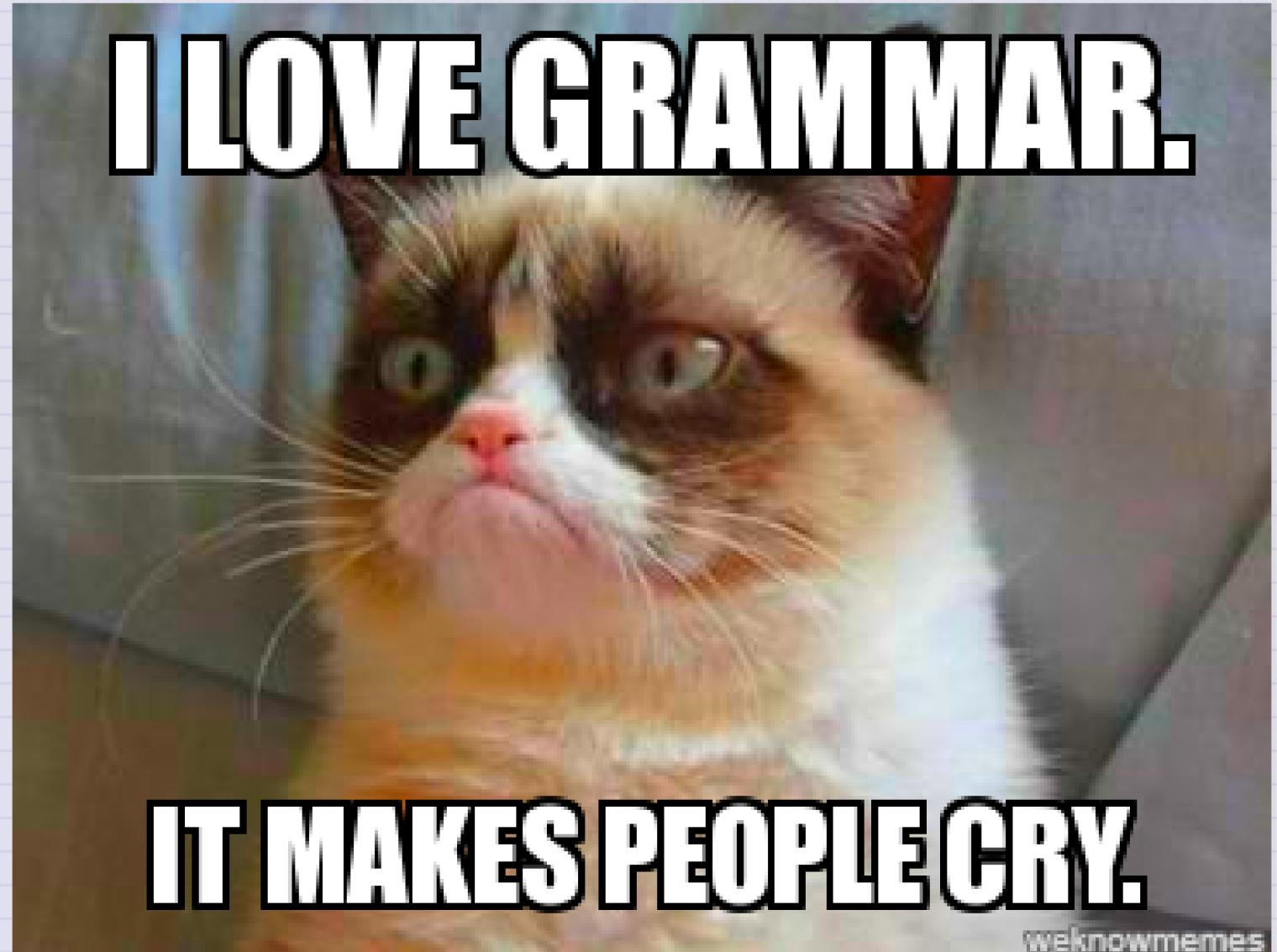
## Rice University

PhD, Linguistics  
MA, Linguistics



## Experience

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



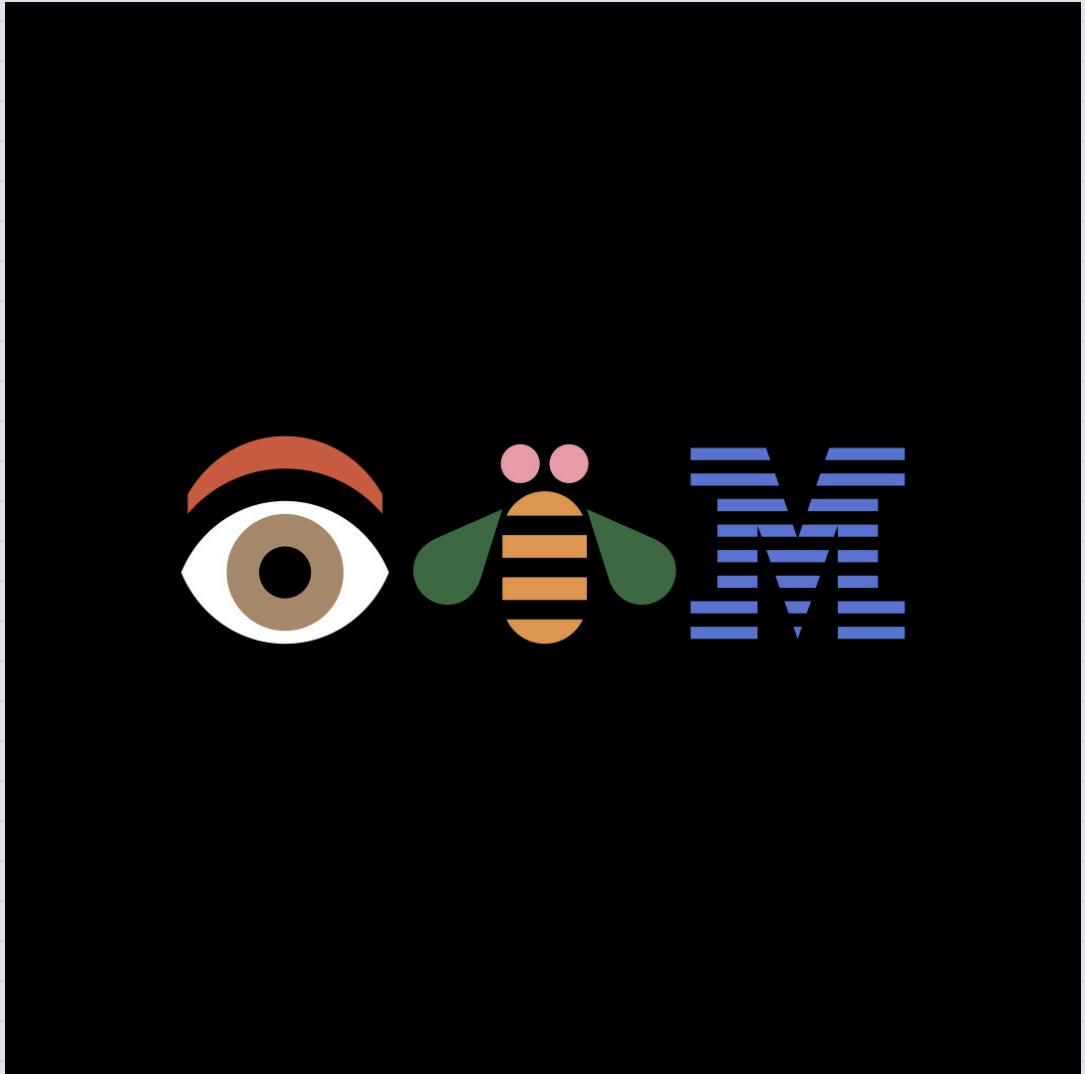
## Experience

-  Postdoc researcher at *Peking University*



# Experience

-  AI engineer at  
IBM



# IBM Business Divisions

[>> SOURCE](#)

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

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# Intro to AI



# 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.



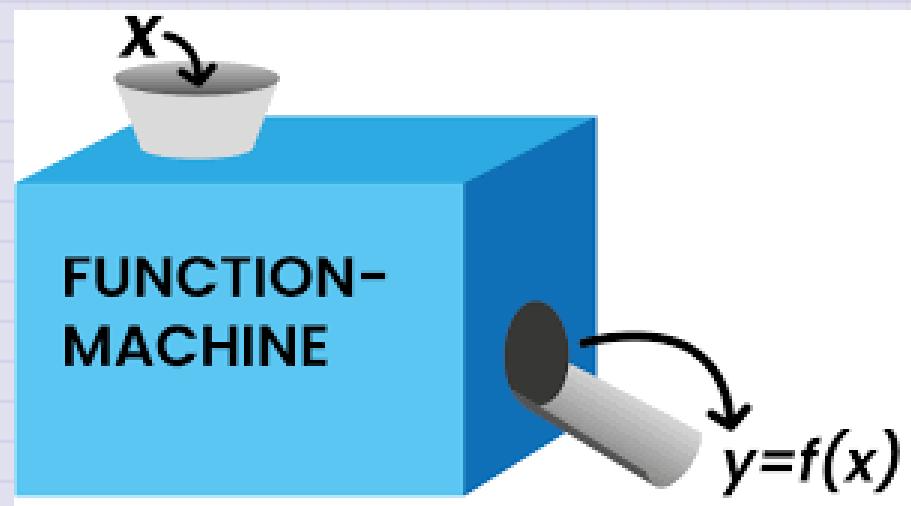
## Deep Learning

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

- Linguistics

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

- Programming

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

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

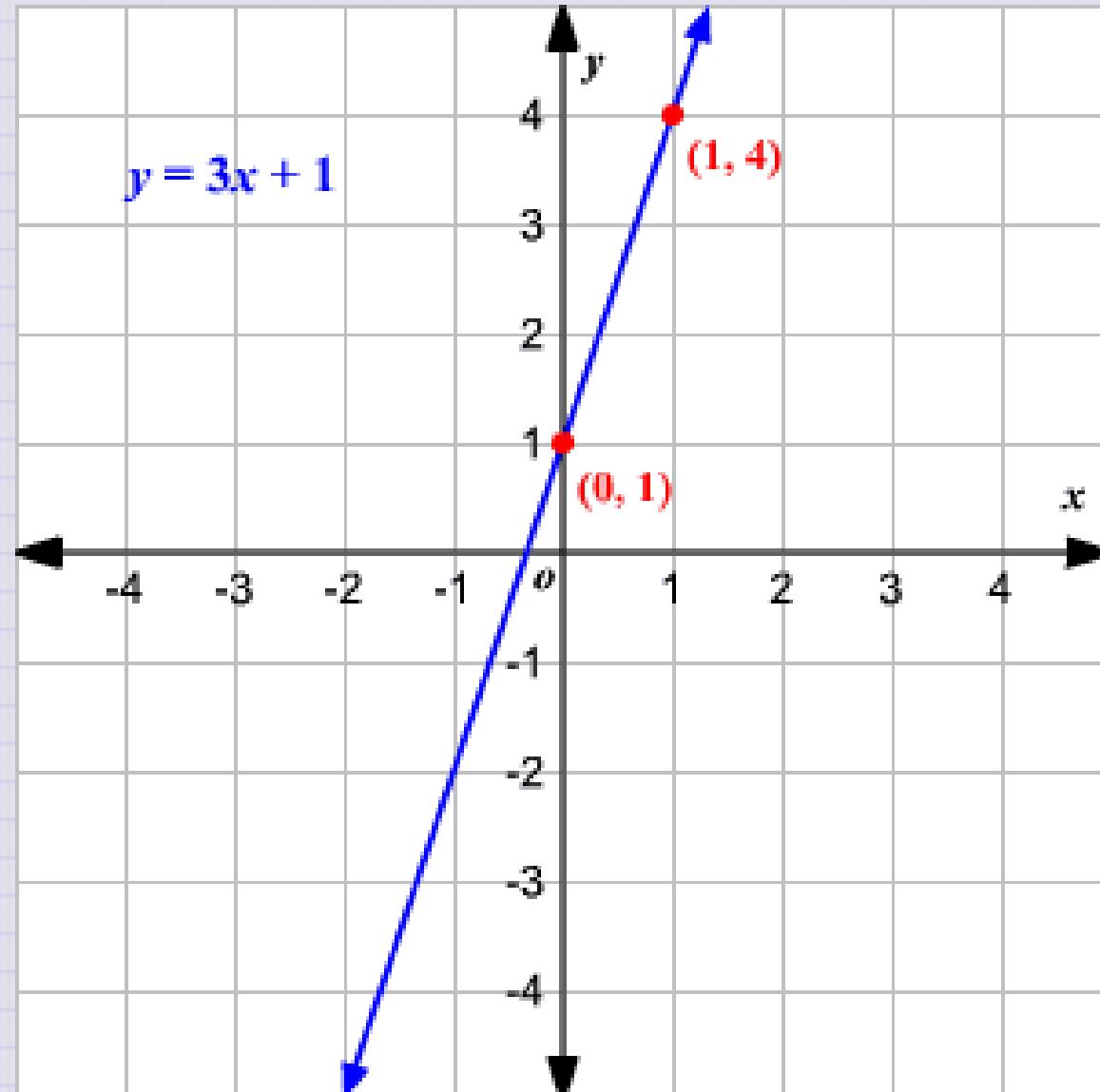
# Data-driven AI

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
```

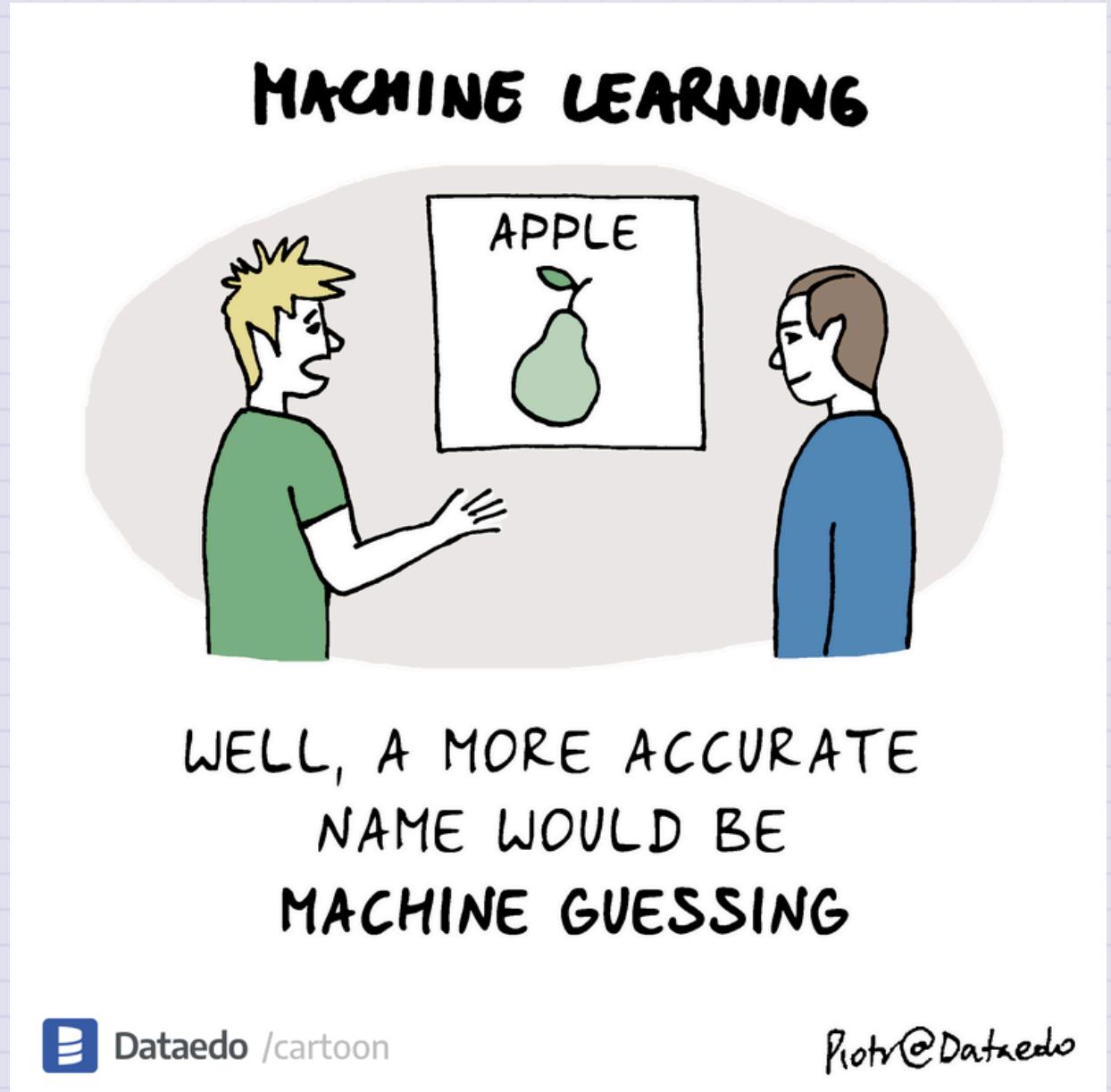
Random:  $y = 0.1x + 0.5$

Trained:  $y = 3x + 1$



# How do machines learn?

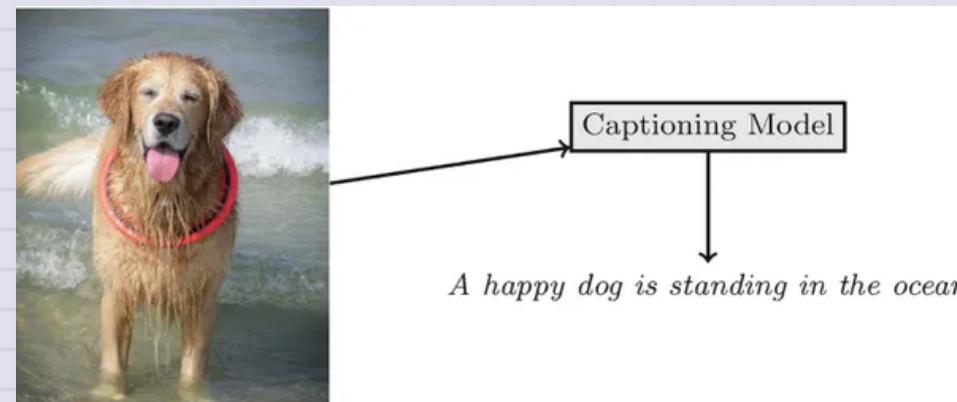
Machines learn by **trial and error**, just as humans do.



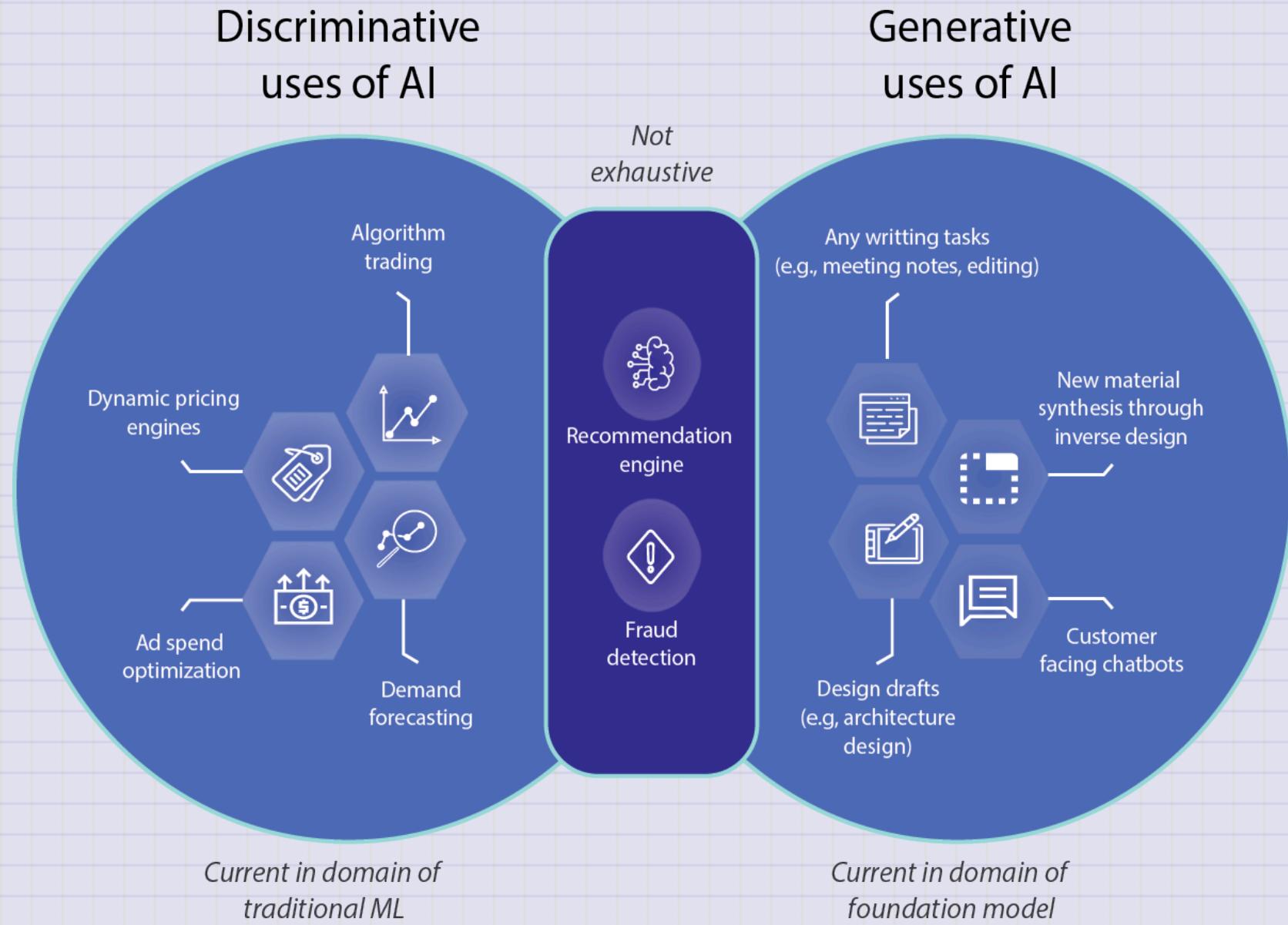
# Why is machine learning powerful?

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

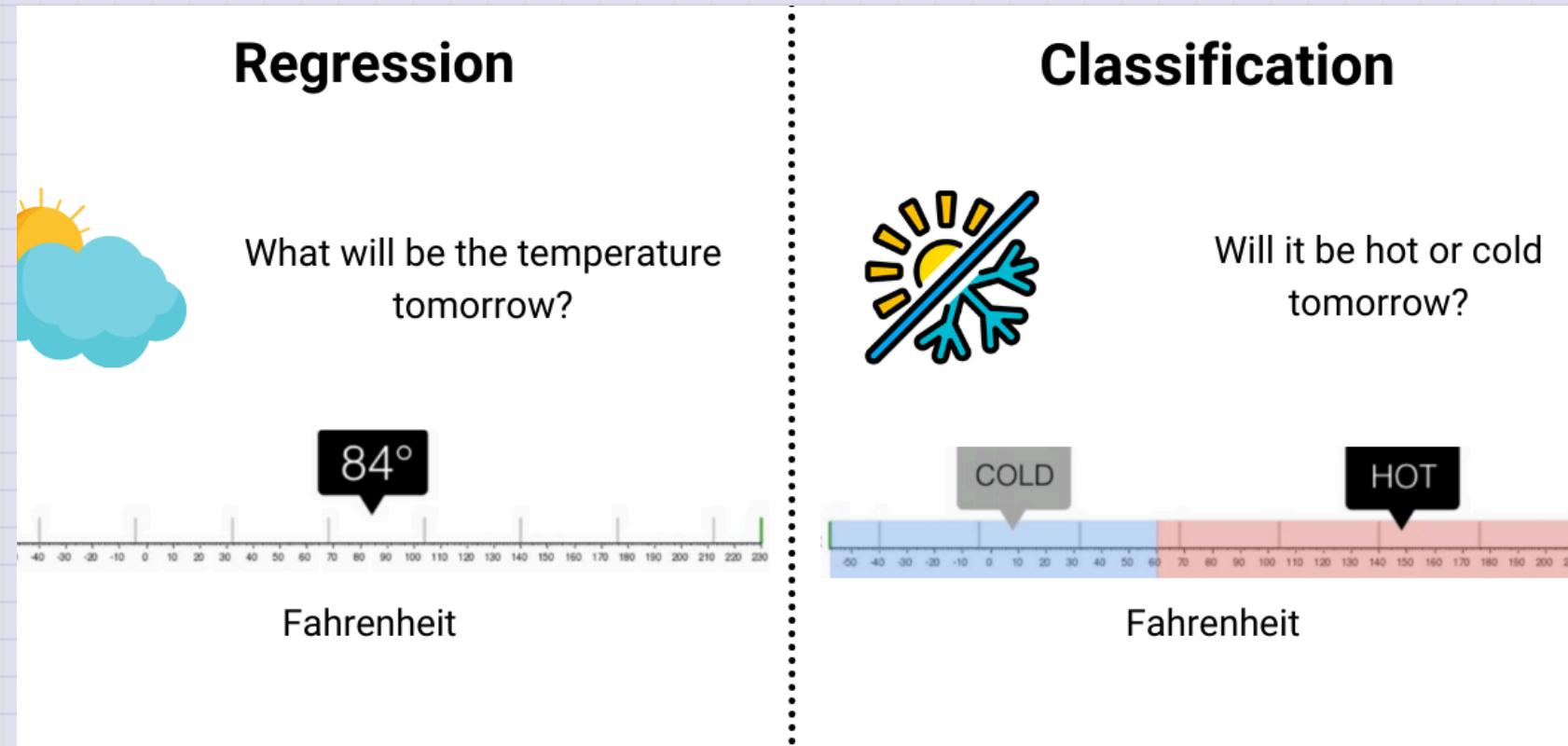
- humans only need to provide input and output
- computers are in charge of figuring out the right process, which is called a **model**



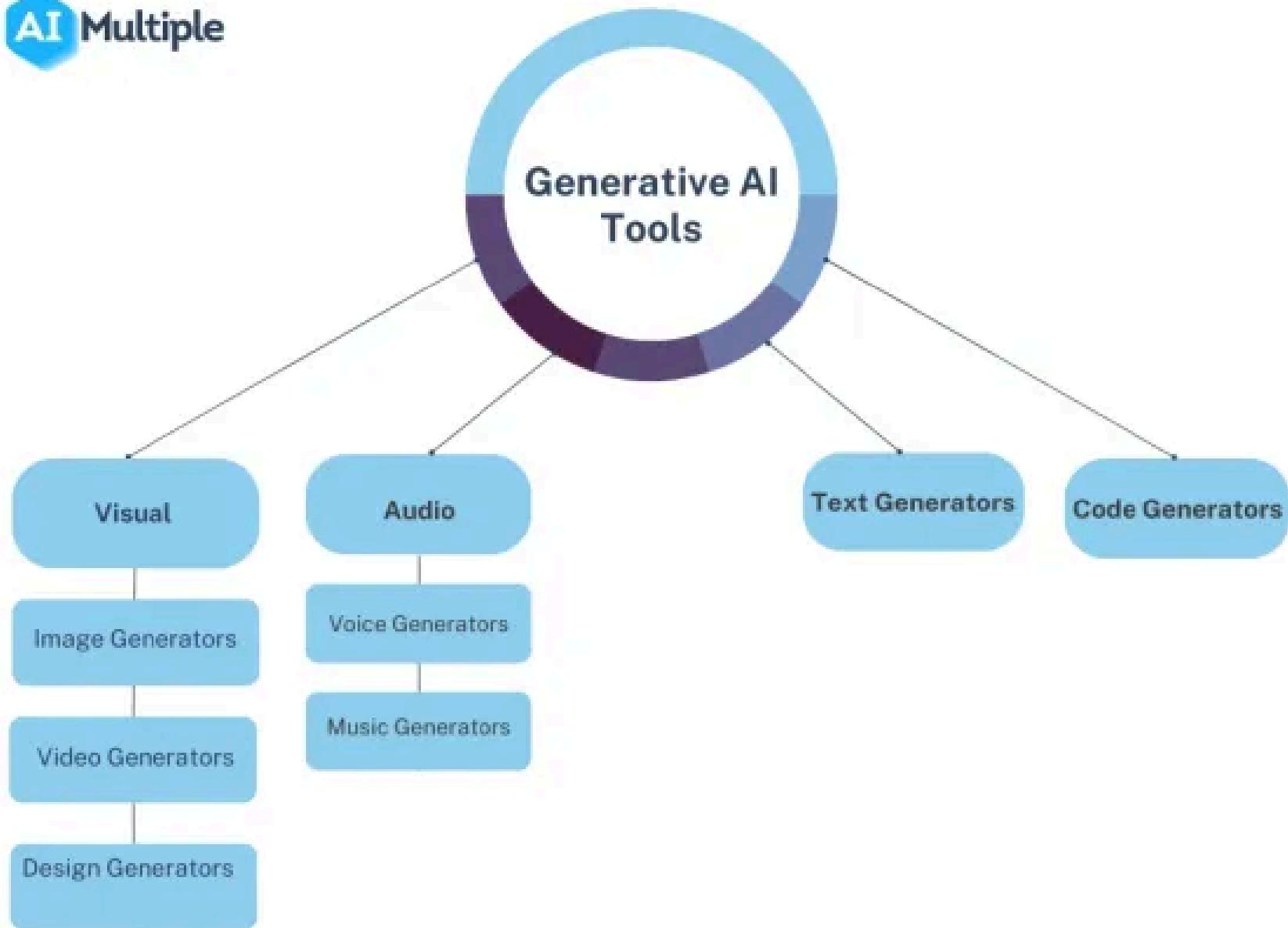
- 2 types of AI



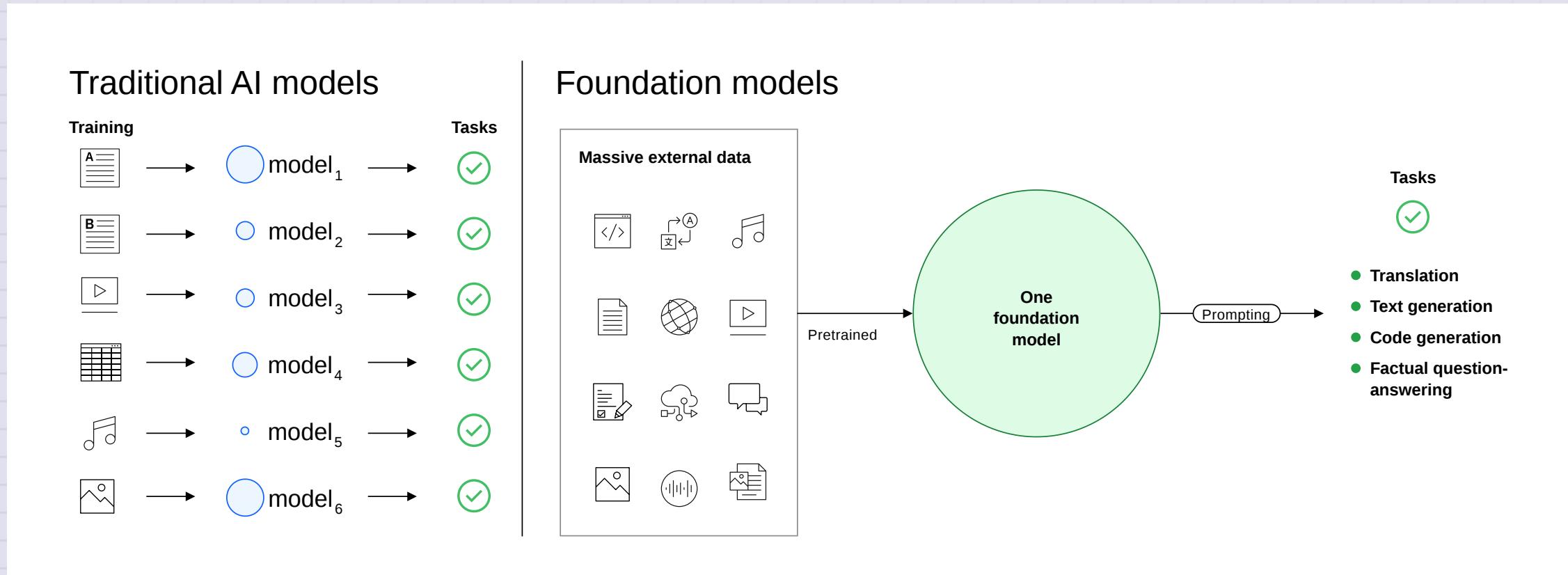
- 2 types of discriminative models



- 4 types of generative models

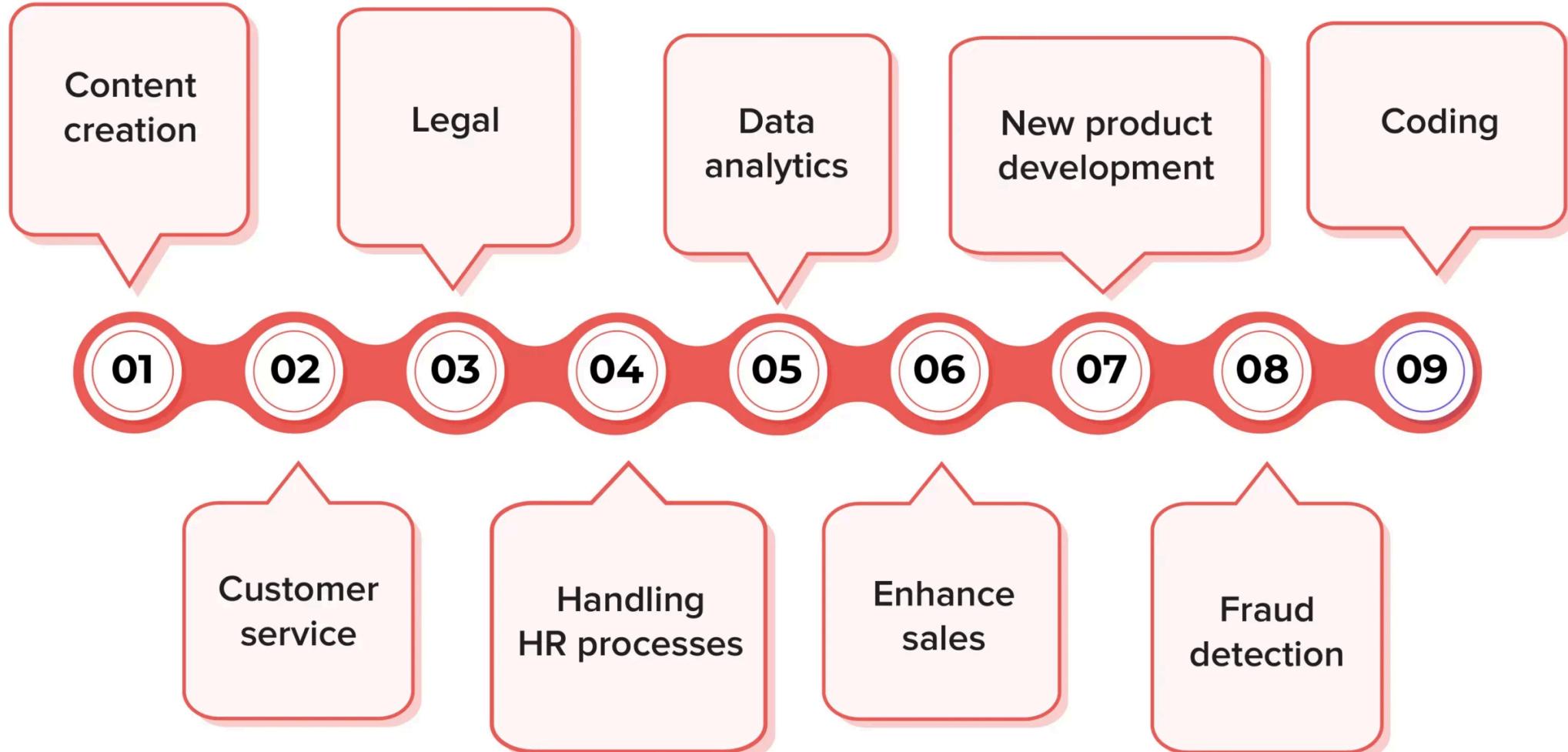


- Traditional AI vs Generative AI

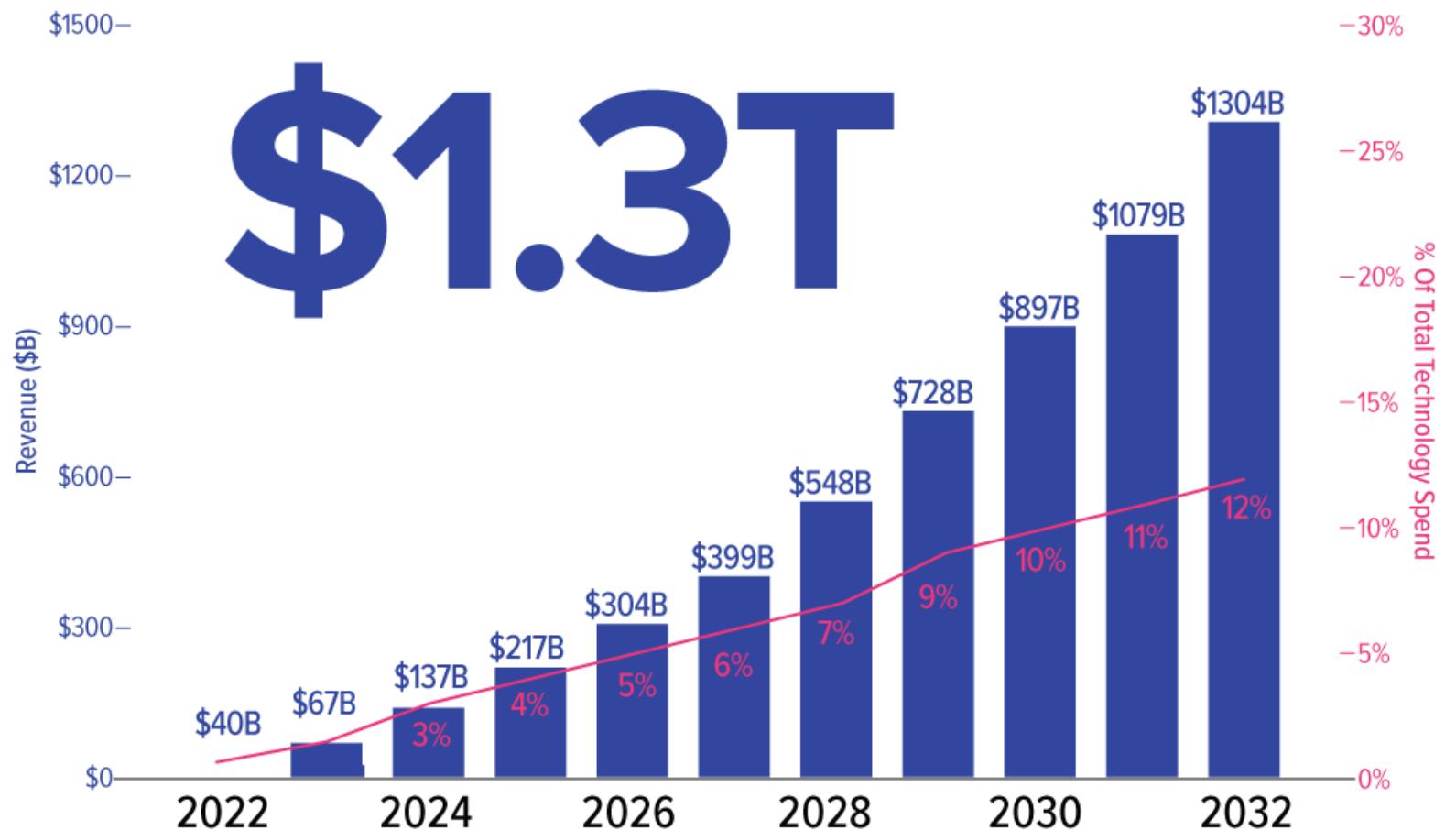


[>> source](#)

# Use cases of generative AI for business



# Generative AI Market Forecast by Revenue and Technology Spend



# Large Language Models

UNDERSTANDING THEIR IMPACT

Exploring Large  
Language Models

# ChatGPT's significance

[>> TechGoing](#)

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

~ Bill Gates

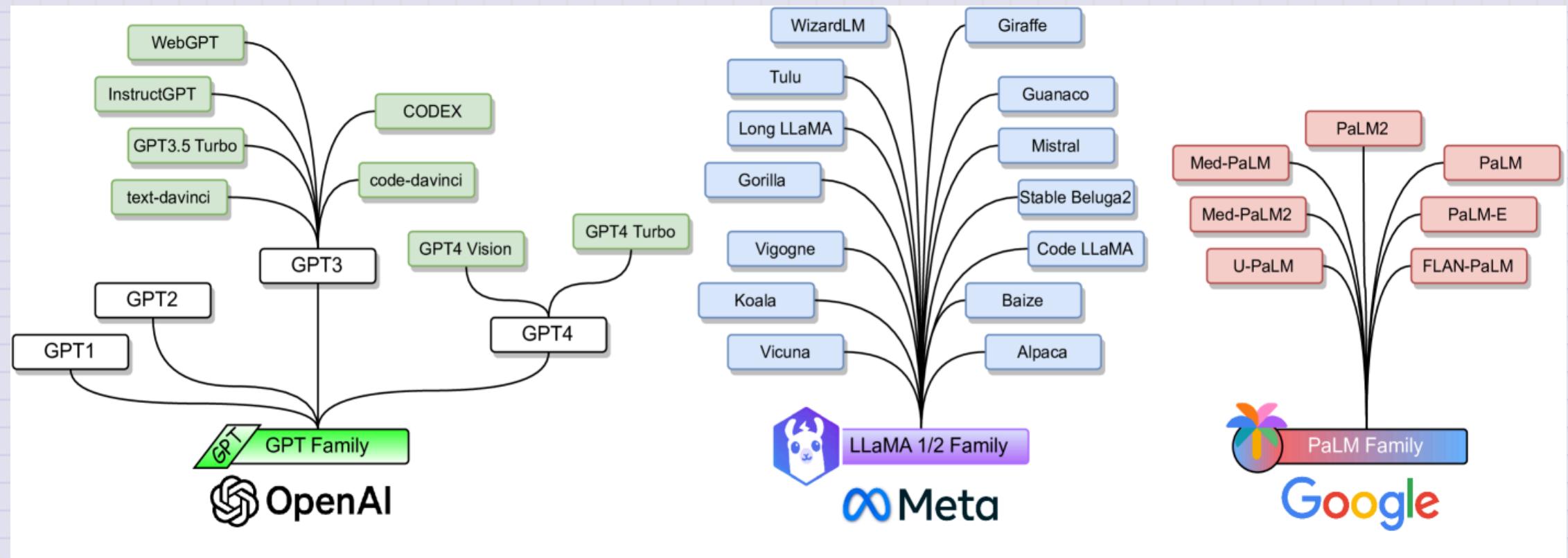


## ChatGPT's model

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

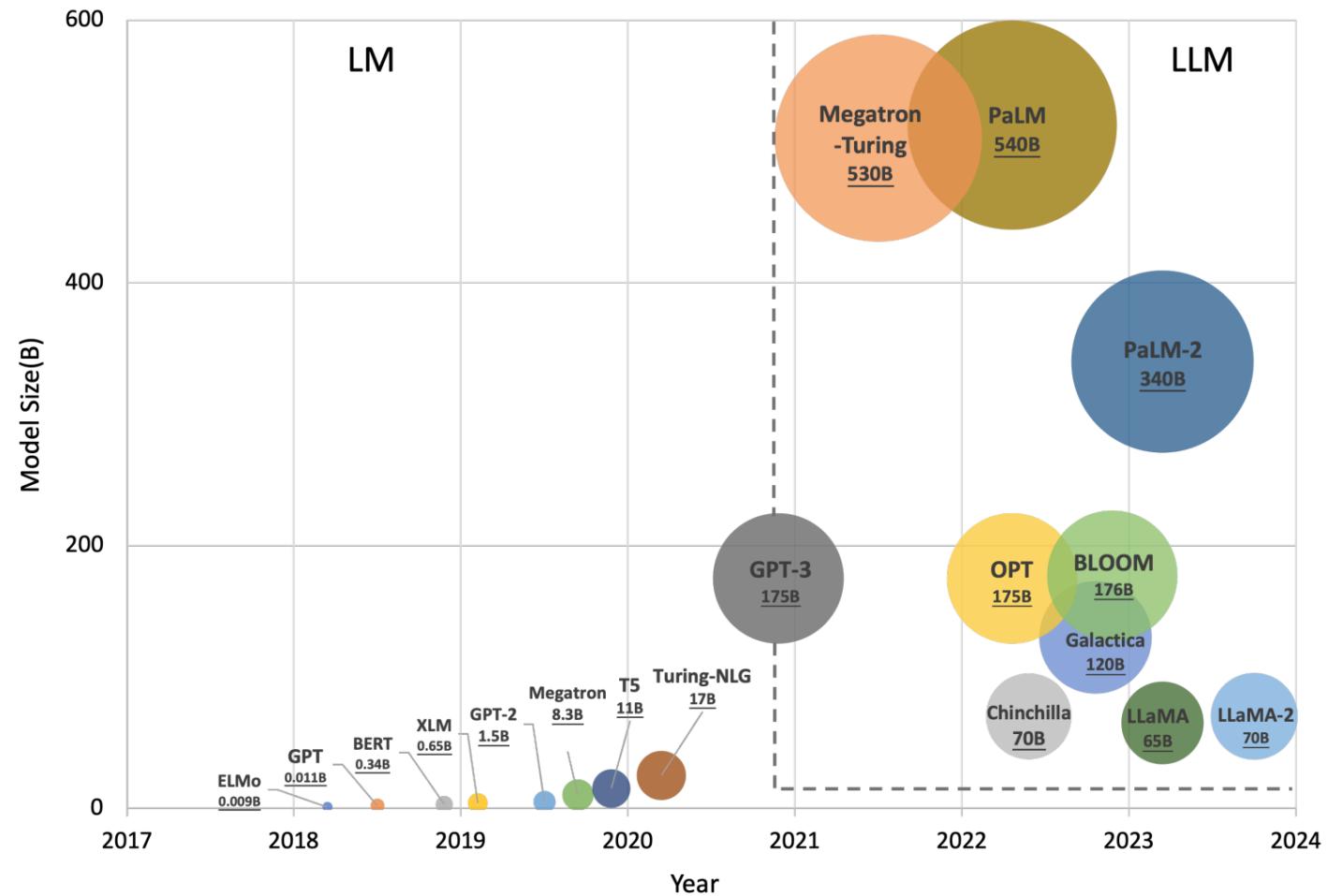


# The LLM family



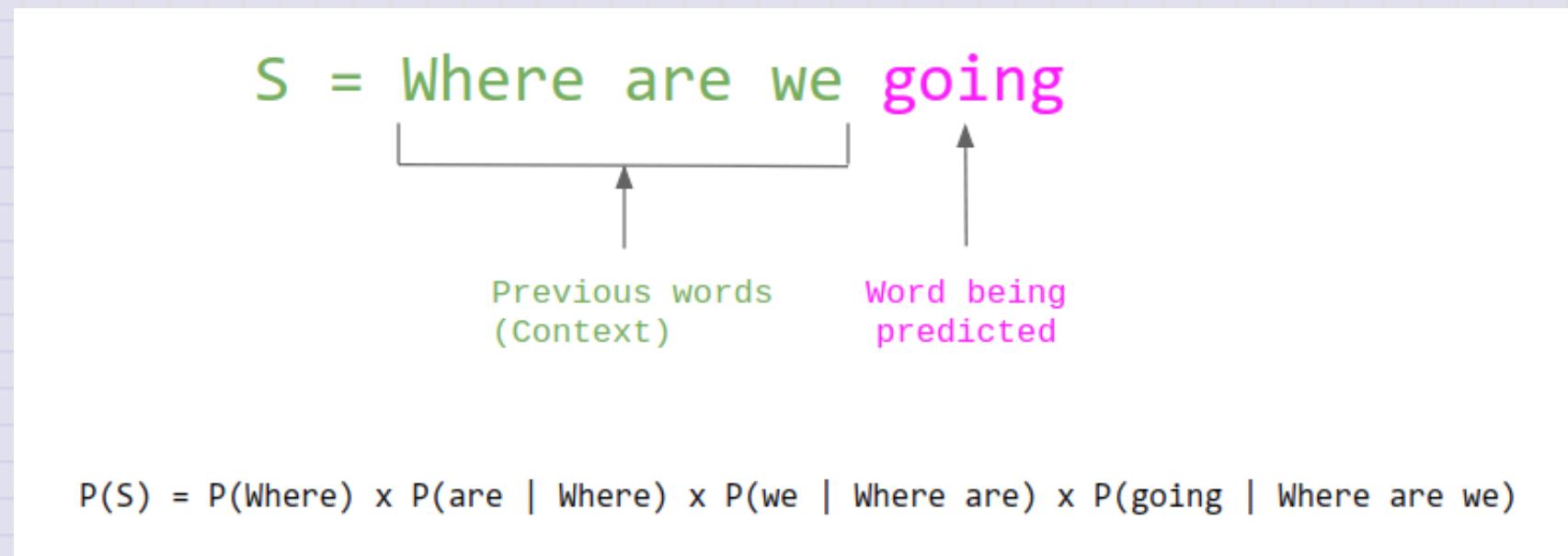
# What makes LLM large?

LLM is large because of the size of its parameters.



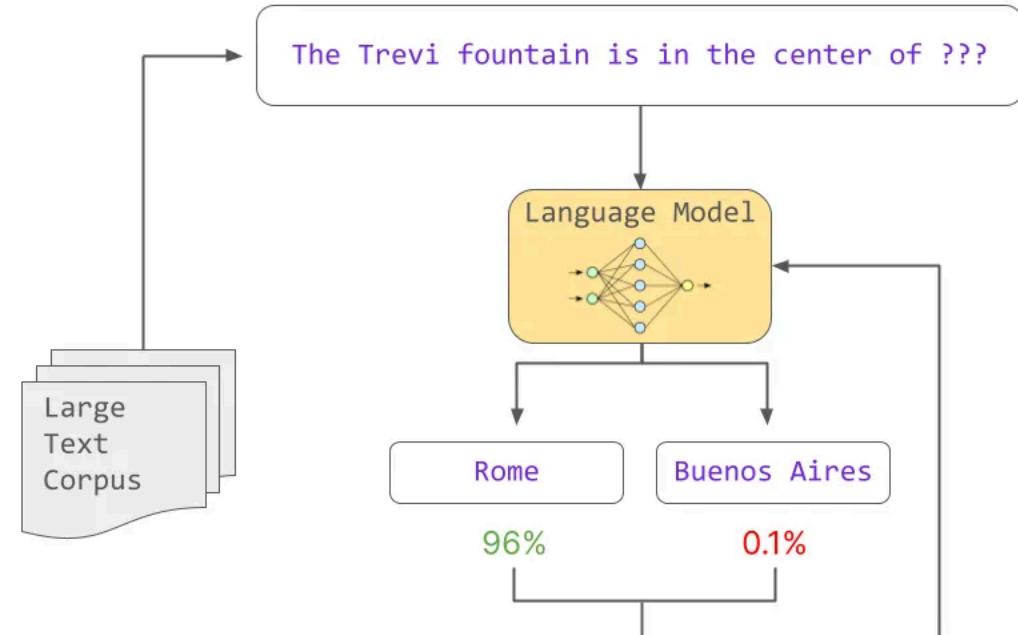
# What is a language model?

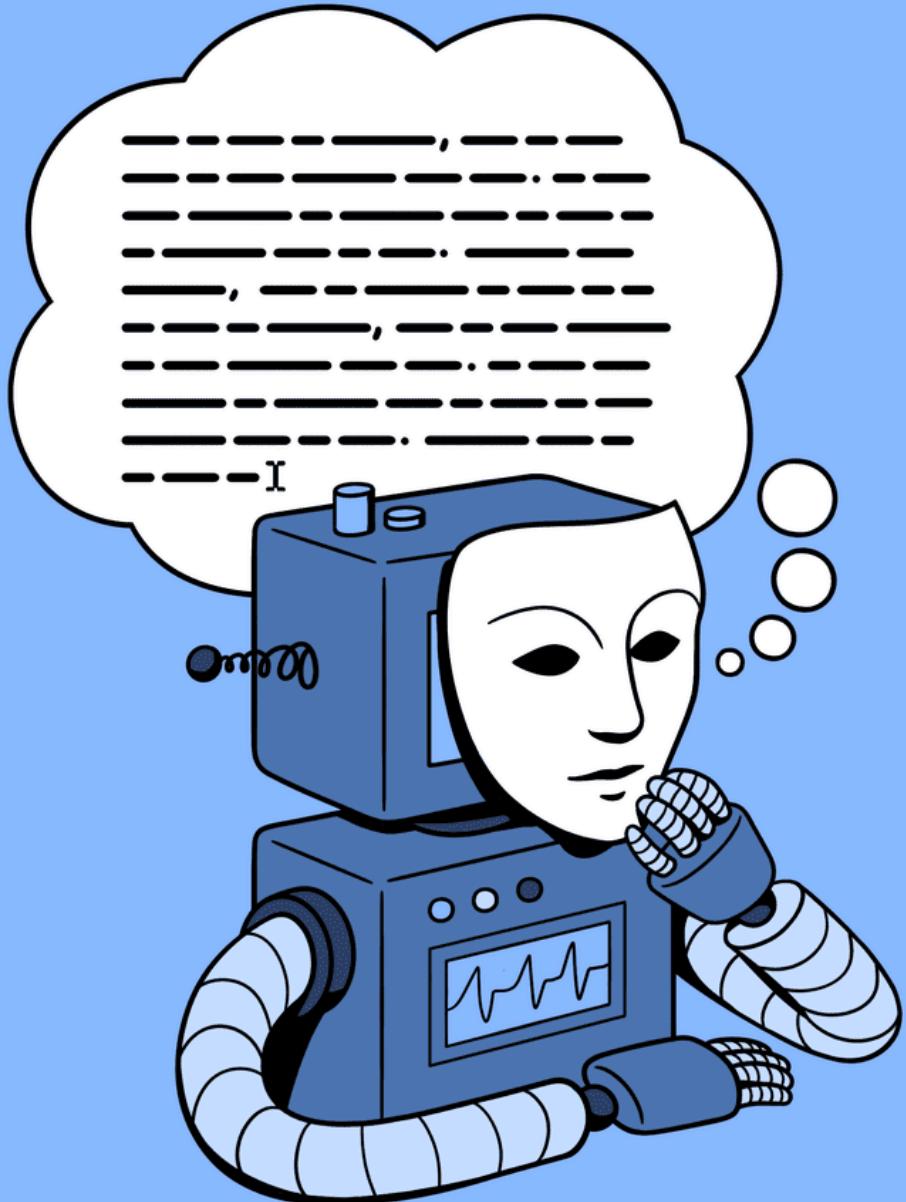
- A language model predicts the next word based on conditional probability.



# 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.

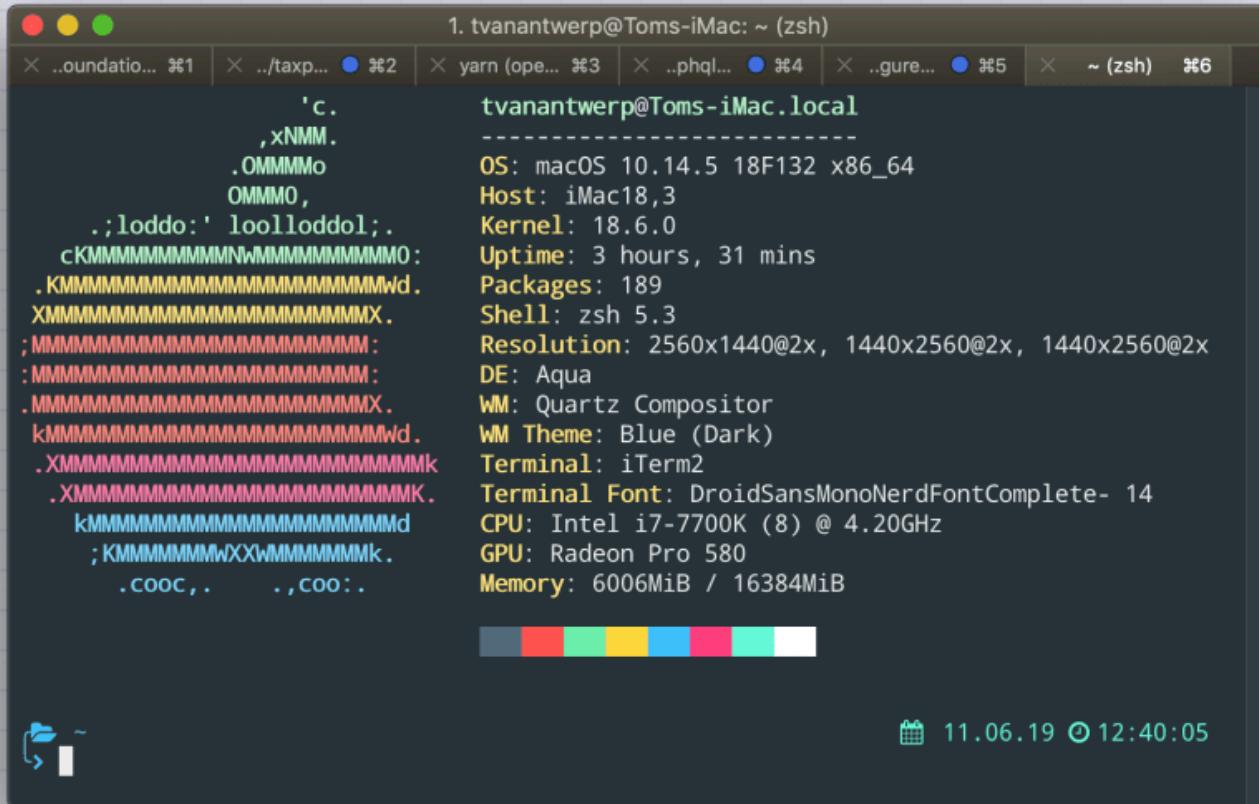
- Top AI chatbots in 2024 powered by LLM
- [>> source](#)

	 ChatGPT	 Google Bard	 Claude AI	 Bing Chat	 OORT AI
Release date	Nov. 2022	Mar. 2023	Mar. 2023	Mar. 2023	Sept. 2023
Key feature	Creativity and human-like conversation	Google ecosystem assistant	Safety and ethics response	Web-based contextual response	Privacy and customization
Language model	GPT-3.4/GPT-4	Gemini (successor to LaMDA and PaLM)	Claude	GPT-4	Enhanced vicuna
Information access	Offline knowledge data	Online internet data	Offline knowledge data	Online internet data	Offline knowledge data
Customer data storage	Centralized	Centralized	Centralized	Centralized	Decentralized
Integration API	Available	Not available	Available	Not available	Available

prompt:

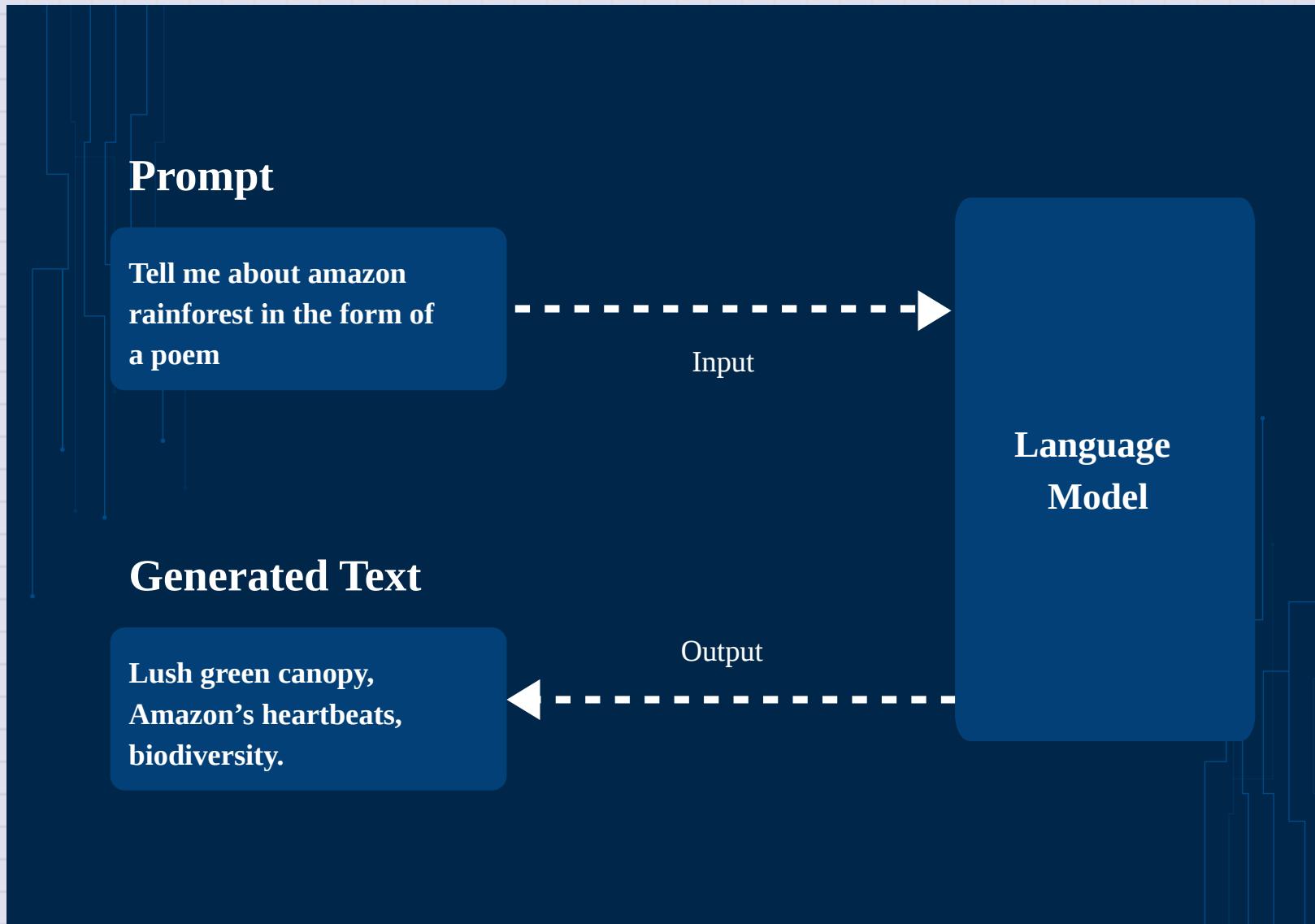
# Prompt Engineering & Linguistics

# Prompt on the terminal

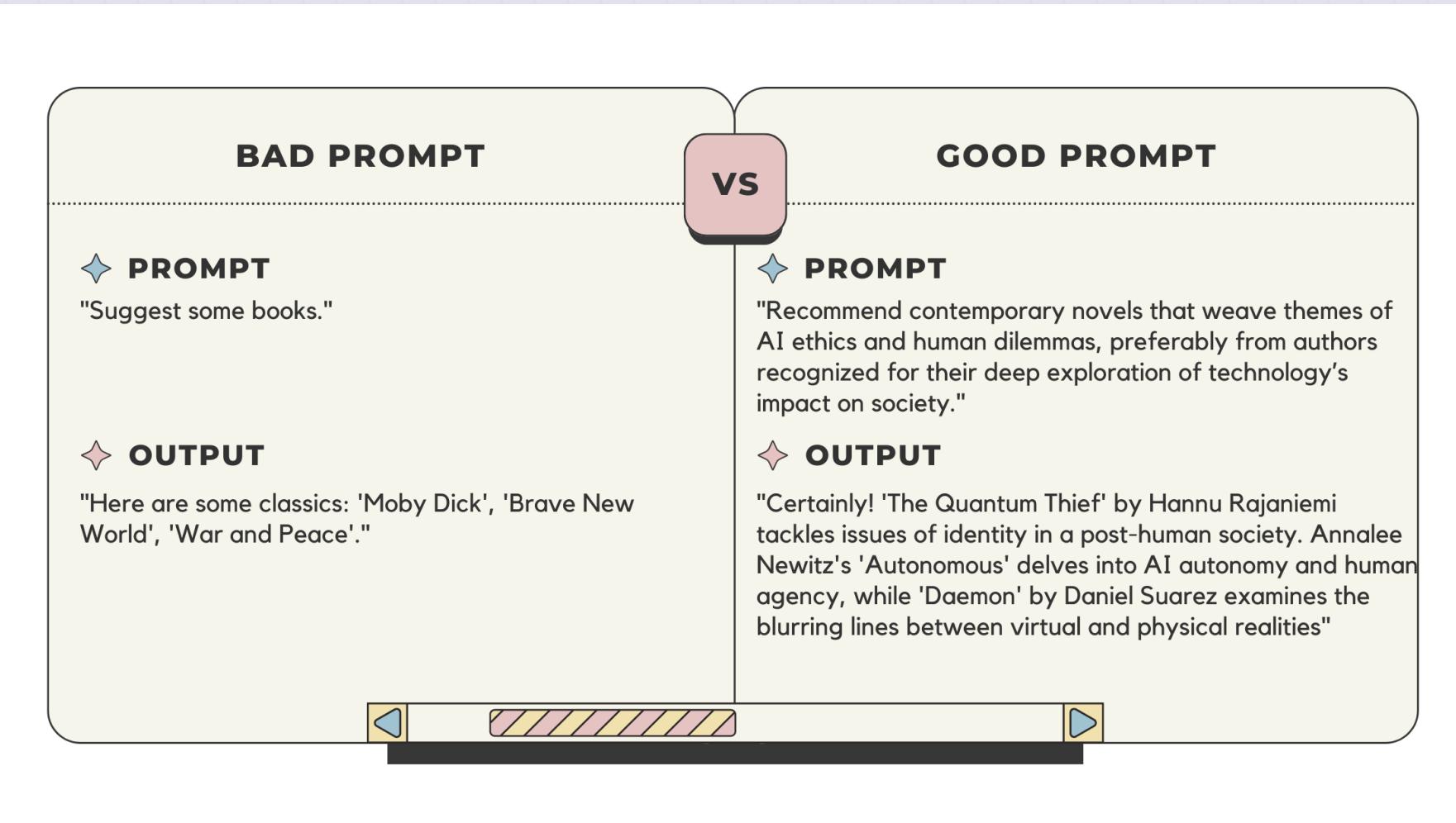


# Prompt in GenAI

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

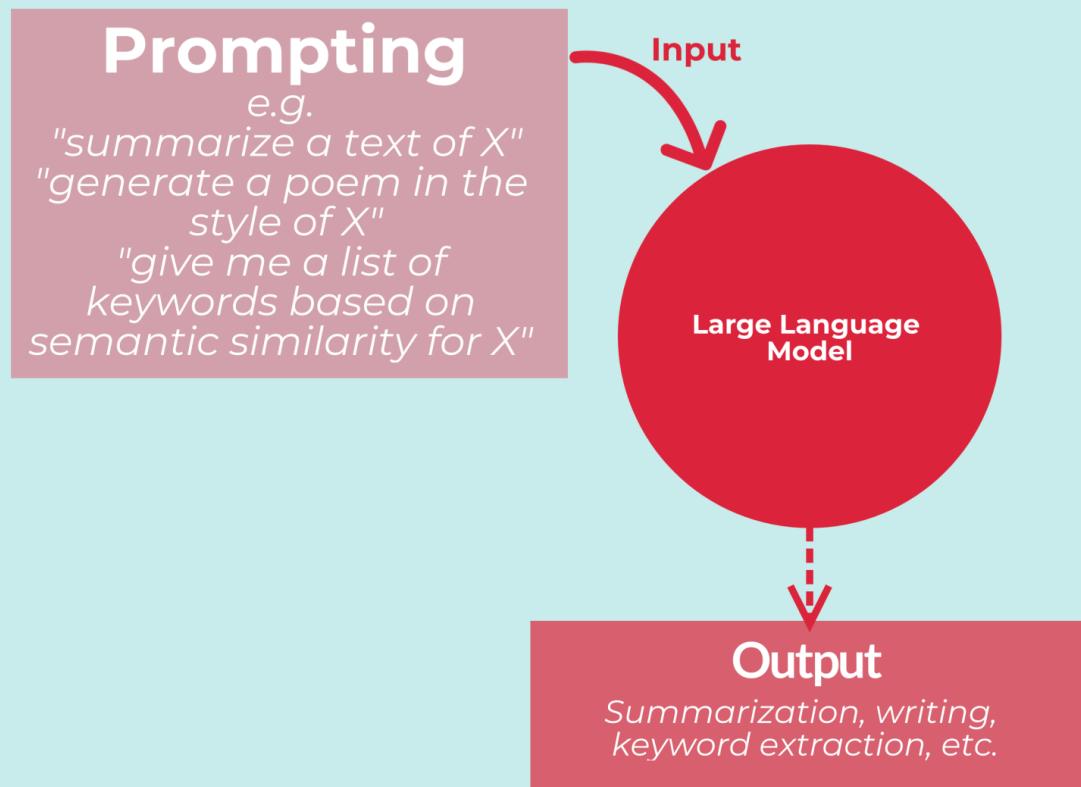


# What makes a good prompt?



# 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.



# Prompt Engineer



## The Role

- Work with cross-functional teams to discuss product development
- Identify uses of AI tools
- Design, develop and refine AI-generated text prompts

## Background

- Bachelor's degree in Computer Science or Machine Learning or a related field
- Additional certifications recommended

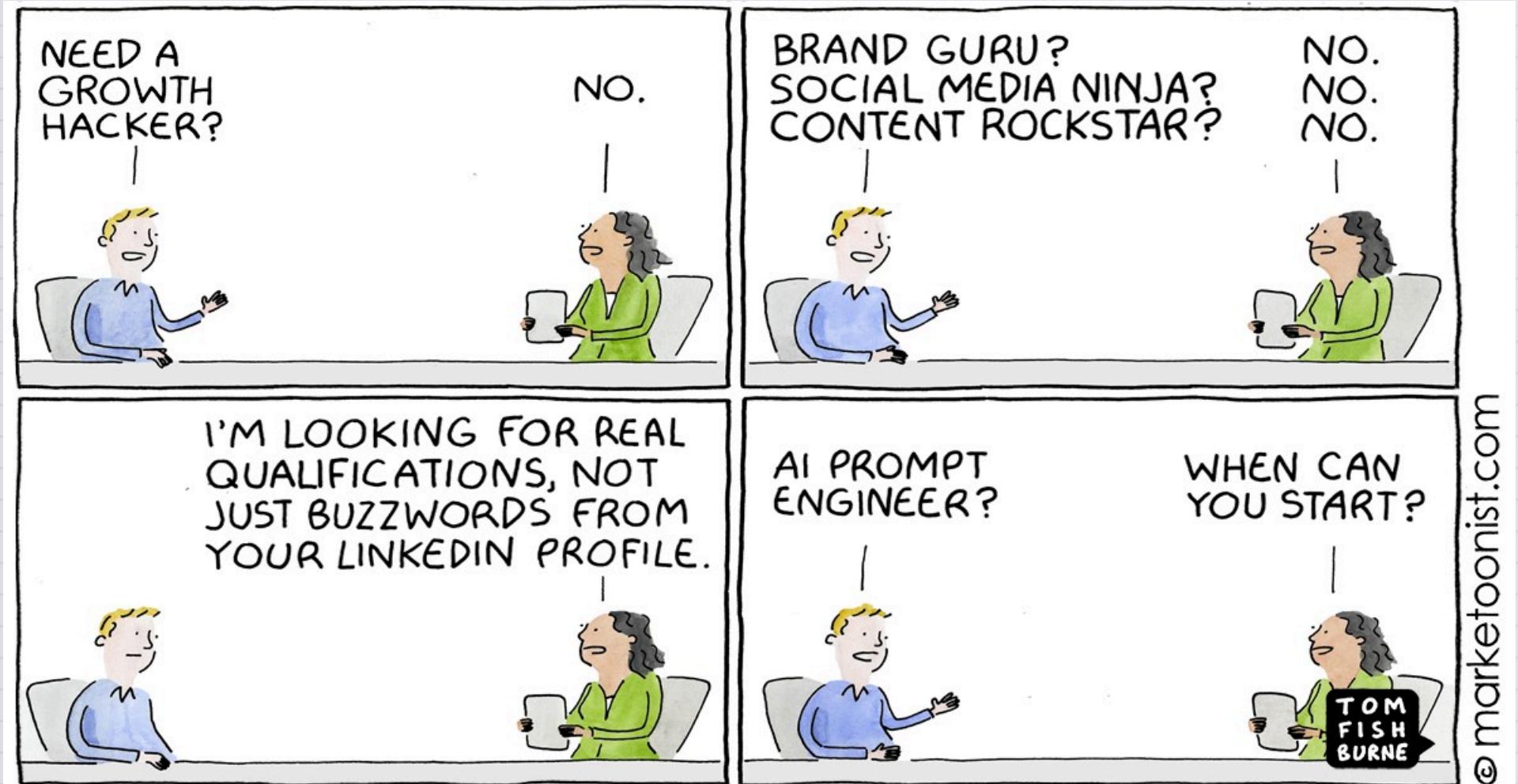
## Skills

- Excellent knowledge of natural language processing
- Knowledge of machine learning
- Comprehensive knowledge of AI-generated content development

## Salary

Junior: \$ 280,000  
Average: \$ 327,000  
Senior: \$ 375,000

# Prompt engineers are in high demand.



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Prompt  
engineering  
requires soft  
skills.

## 5 non-tech prompt engineering skills



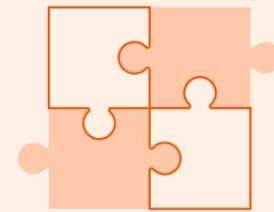
Language



Communication



Creativity



Critical thinking



Subject matter expertise

# Prompt engineering skill - language

Linguistics plays a vital role in prompt engineering.

- 1. Language Structure:** Understanding of language structure helps in designing effective prompts.
- 2. Semantic Analysis:** Understanding the meaning of words, phrases, and sentences helps in creating more precise prompts.
- 3. Pragmatics:** Understanding the context in which language is used can lead to the creation of more effective prompts.

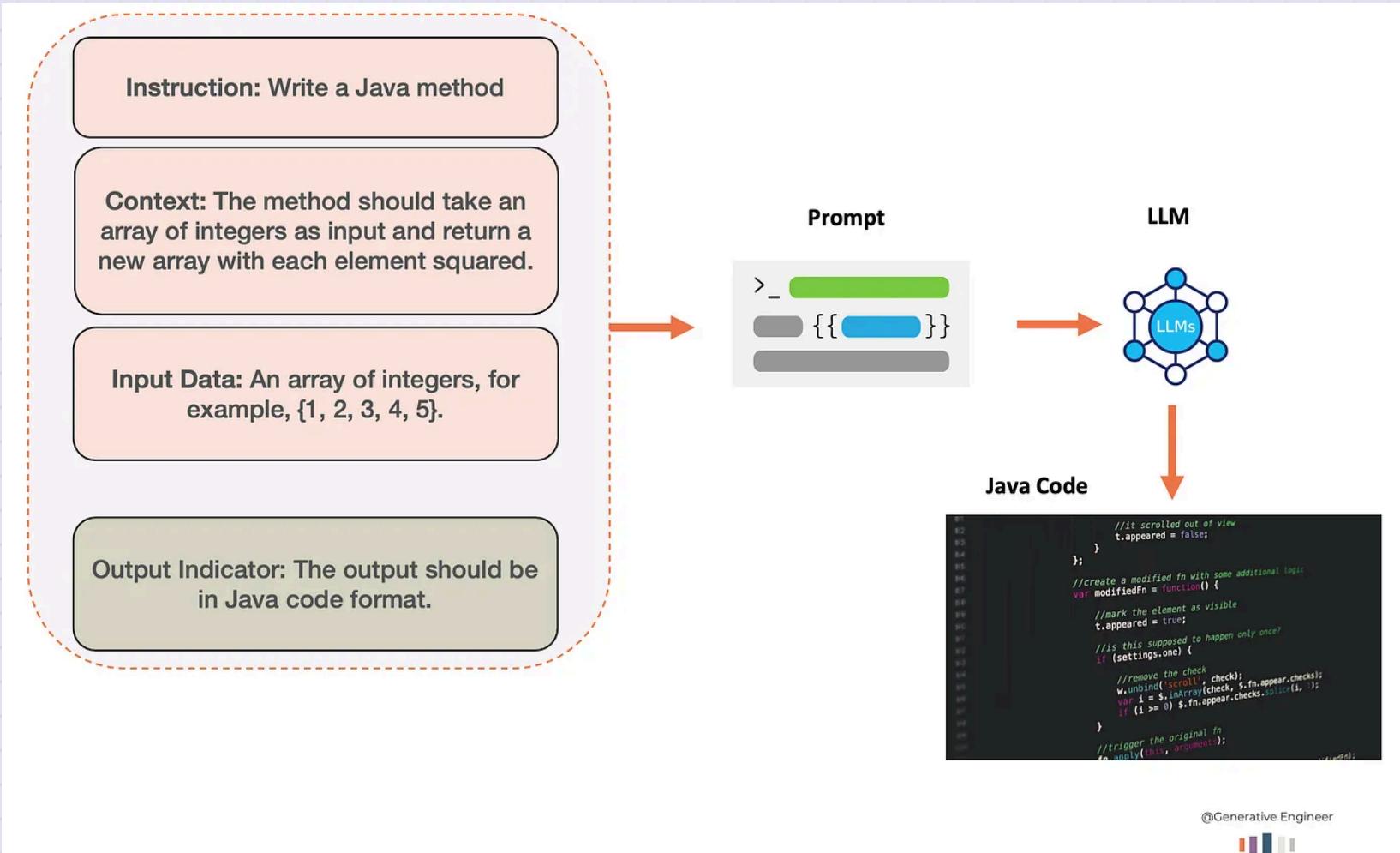
- Elements of a good prompt



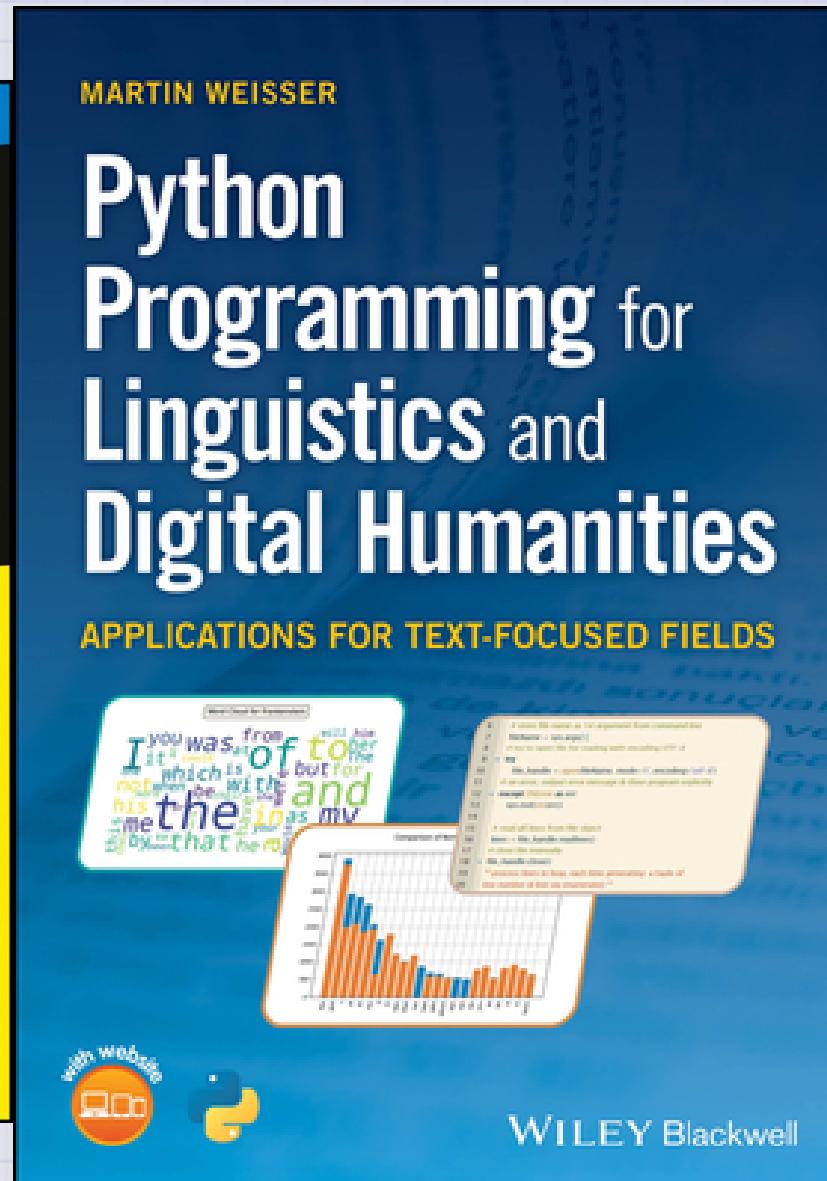
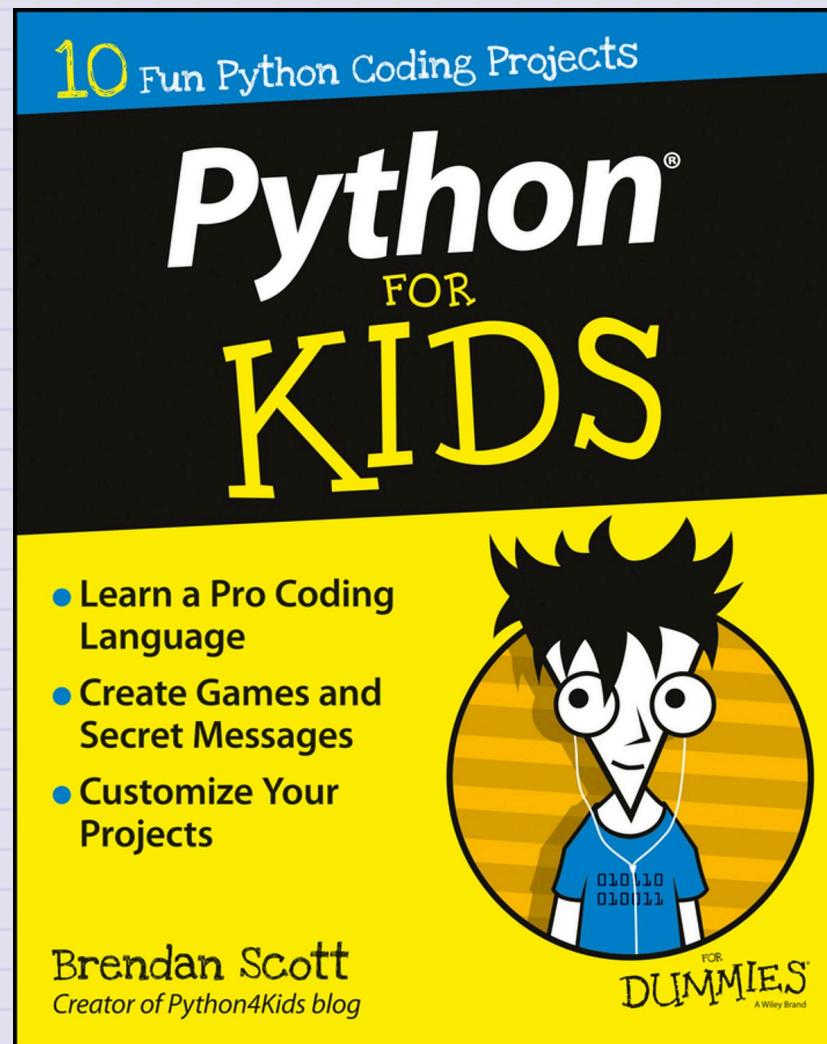
# Prompt engineering skill - critical thinking

Prompting Approach	Description	Comparison to Human Thinking
<b>Zero-shot Prompting</b>	AI answers without prior examples, using its training	Like answering a question using only what you already know.
<b>Few-shot Prompting</b>	AI uses a few examples to understand how to respond.	Learning from a few examples before trying something new.
<b>Chain-of-Thought Prompting</b>	AI breaks down its process into steps before answering.	Thinking through steps to solve a problem, like in math.
<b>Self-Consistency</b>	AI generates multiple answers and picks the most consistent one.	Choosing the best solution after considering several options.
<b>Generate Knowledge Prompting</b>	AI creates new ideas or information.	Using imagination or knowledge to come up with new ideas.
<b>Prompt Chaining</b>	Sequential prompts guide AI through a process to a result.	Following steps in a plan to achieve a goal.
<b>Active-Prompt</b>	Prompts adjust based on AI's responses in real-time.	Adjusting conversation based on feedback, like in a dialogue.
<b>Directional Stimulus Prompting</b>	Prompts direct AI towards a desired outcome.	Organizing thoughts or information in a structured way.
<b>Multimodal CoT</b>	AI organizes information in graph structures for tasks.	Organizing thoughts or information in a structured way.

# Prompt engineering skill - coding



Start with Python  
🐍 if you want to  
try programming.





◆ 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.

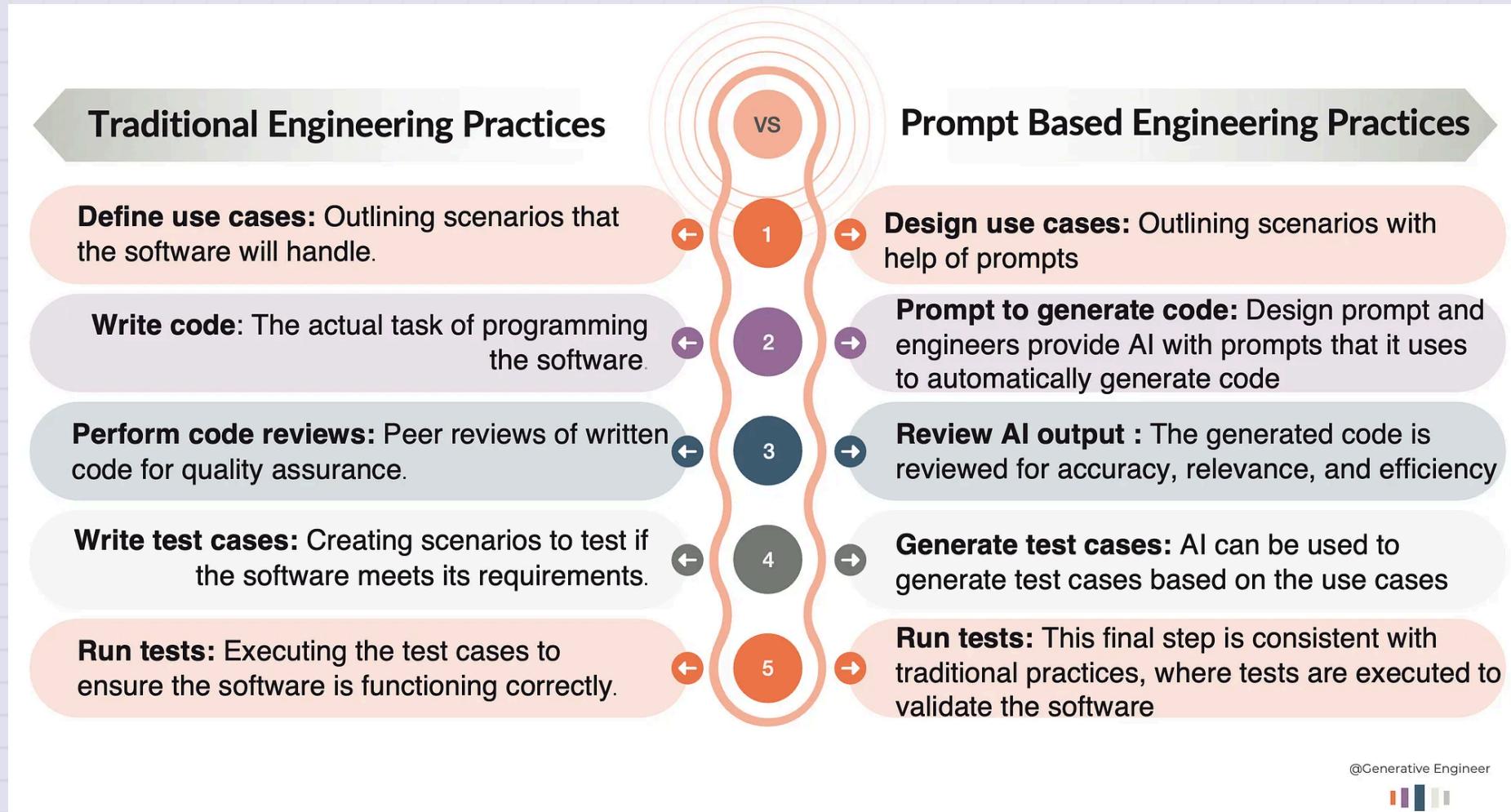


Facundo Santiago · [Follow](#)

10 min read · May 9, 2023

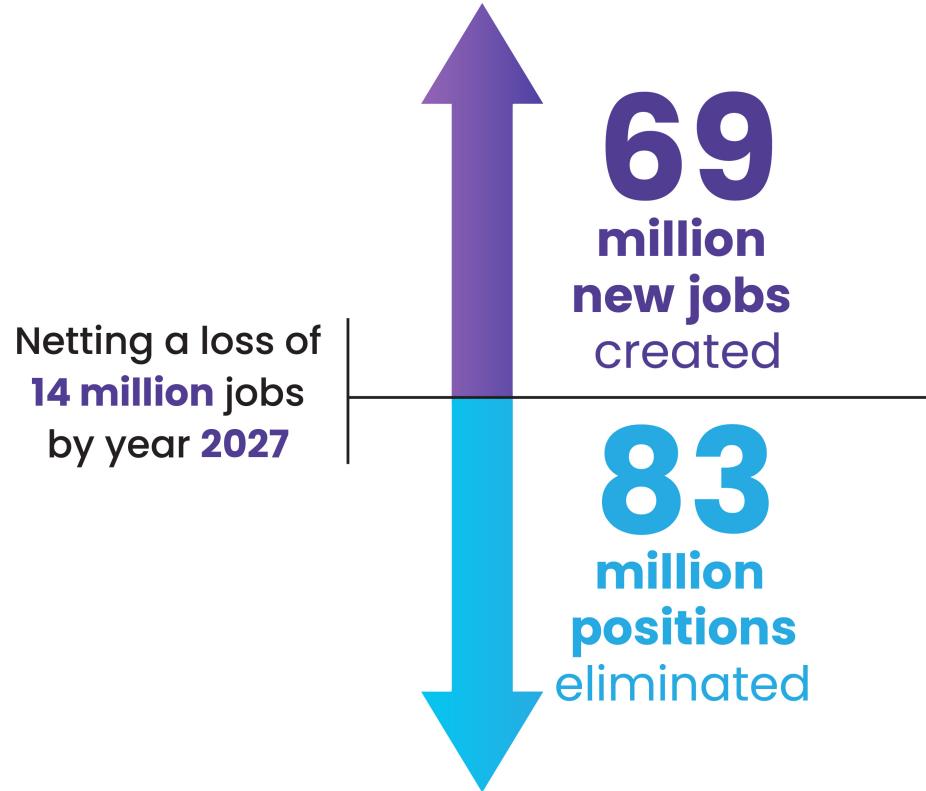
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# GenAI creates engineering paradigm shift.



# GenAI's impact on future jobs

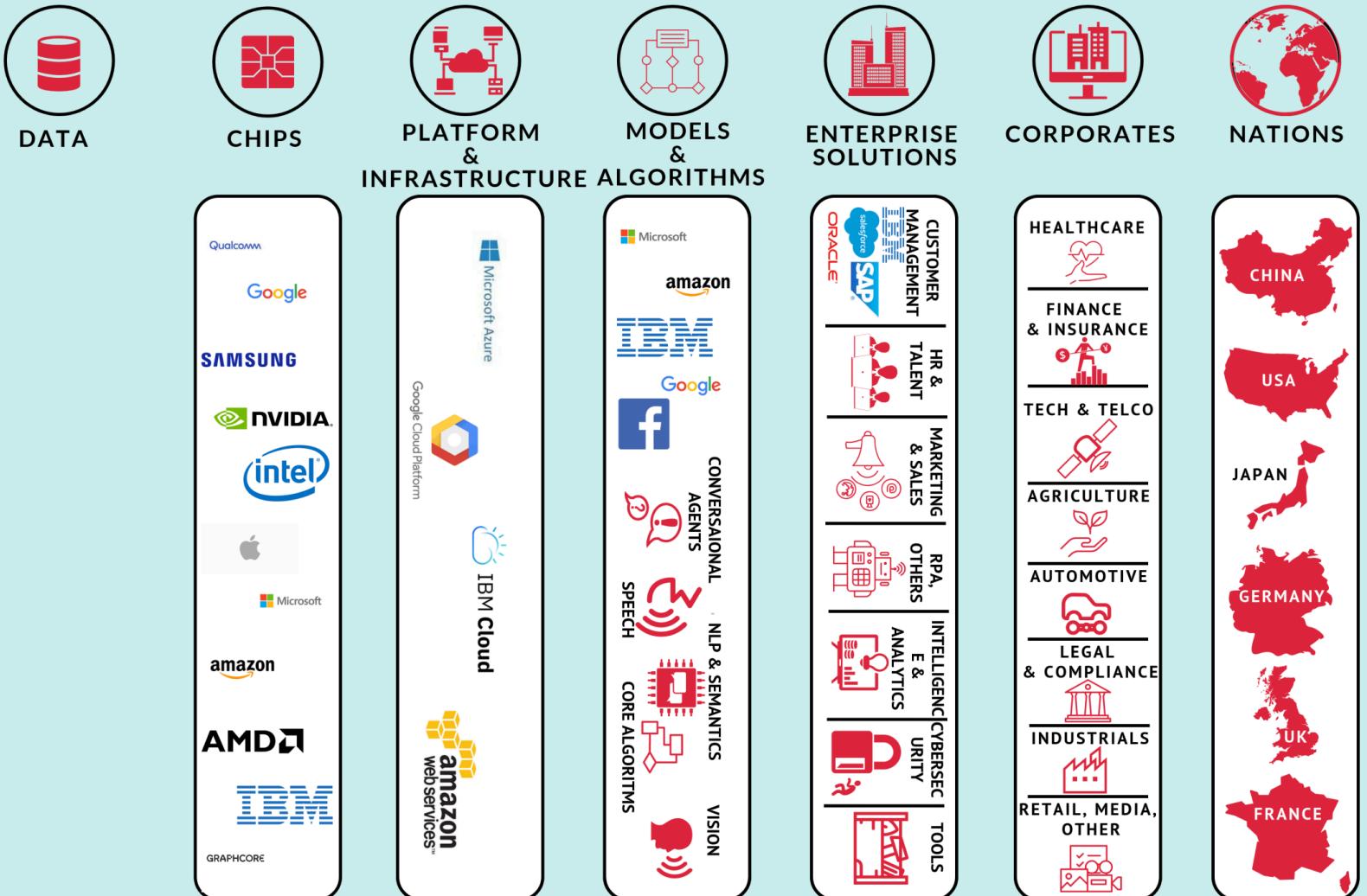
[>> source](#)



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

# AI Business Models

The AI Ecosystem has generated a multi-billion dollar industry, and it all starts from data. Going upward in the value chain there are the Chips (GPUs) that allow the physical storing of Big Data (a dominant player is NVIDIA). That Big Data will need to be stored on platforms and infrastructures that SMEs can't afford. That is where players like Google Cloud, Amazon AWS, IBM Cloud and Microsoft Azure come into rescue. At large scale, a few corporations control the Enterprise AI market; while nations like China, USA, Japan, Germany, UK, and France have widely bet on it!



## Example: extracting ordered items from a text

- Online order

Hey there! I'd like to make an order for pick-up. Could I get one large fries, two fish fillet sandwiches, three cheeseburgers with no onions, and four vanilla milkshakes? Oh, and could you also add five apple pies to that order? Thanks a lot!

## Example: extracting ordered items from a text

- Using knowledge of linguistics

```
[  
{'LIKE_NUM': True},  
{'POS': 'ADJ', 'OP': '?'},  
{'POS': 'NOUN', 'OP': '+'}]
```

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

# Outcome of the extraction

The screenshot shows a dependency parser interface with three extraction rules defined on the left and their results on the right.

**Rule 1:** LIKE\_NUM →  (green checkmark)

**Rule 2:** POS → ADJ  
POS → OP ?

**Rule 3:** POS → NOUN  
POS → OP +

**Buttons at the bottom:**

- add token
- refresh text

The interface shows the extracted text with entities highlighted in yellow boxes:

Hey there! I'd like to make an order for pick-up. Could I get

**one large fries**, **two fish fillet sandwiches**,

**three cheeseburgers** with no onions, and

**four vanilla milkshakes**? Oh, and could you also add

**five apple pies** to that order? Thanks a lot!

Note that this demo currently doesn't indicate overlapping matches.

Show tokens   displaCy ?   displaCy ENT ?

## Example: extracting ordered items from a text

- Using a prompt

You work at a fast food restaurant and are good at summarizing what a customer orders from a text. Extract ordered items from the following text. Use the json format, with two keys, quantity and item:

Text: <Hey there! I'd like to make an order for pick-up. Could I get one large fries, two fish fillet sandwiches, three cheeseburgers with no onions, and four vanilla milkshakes? Oh, and could you also add five apple pies to that order? Thanks a lot!>

## Outcome of the extraction

```
[  
    { "quantity": 1, "item": "large fries" },  
    { "quantity": 2, "item": "fish fillet sandwiches" },  
    { "quantity": 3, "item": "cheeseburgers with no onions" },  
    { "quantity": 4, "item": "vanilla milkshakes" },  
    { "quantity": 5, "item": "apple pies" }  
]
```

See the conversation on >> [Bing Chat!](#)

## Use case: Wendy's drive-thru

Wendy's FreshAI uses generative AI to generate responses and adapt in real-time ... – it's a personalized, responsive experience for every customer. Considering **there are more than 200 billion ways to order a Dave's Double®**, leveraging generative AI is a crucial piece of innovating the Wendy's drive-thru experience for customers. [>> source](#)



## 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.

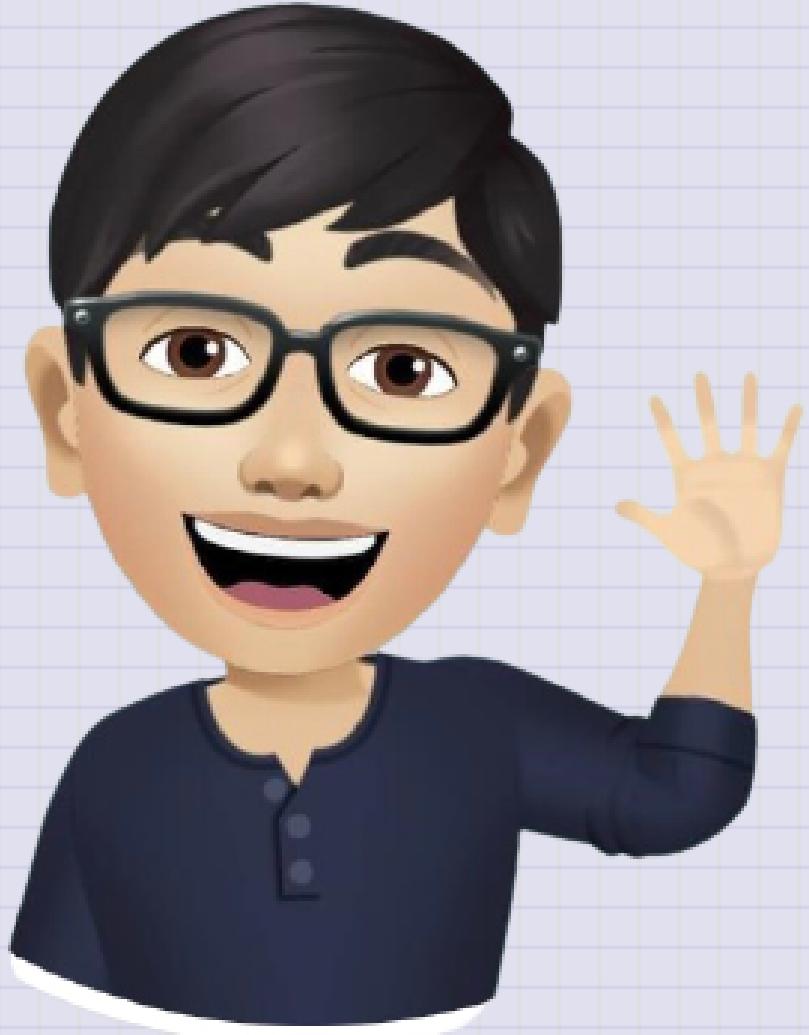
## Take-away messages - 3/3

- **Doing by saying:** The field of generative AI heavily relies on understanding and manipulating language. This is where knowledge of linguistics 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>