

# AI, Prompt Engineering, and Linguistics

Speaker: Dr. Haowen Jiang

Date: May 8th, 2024



# Outline

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

# My background



# Education



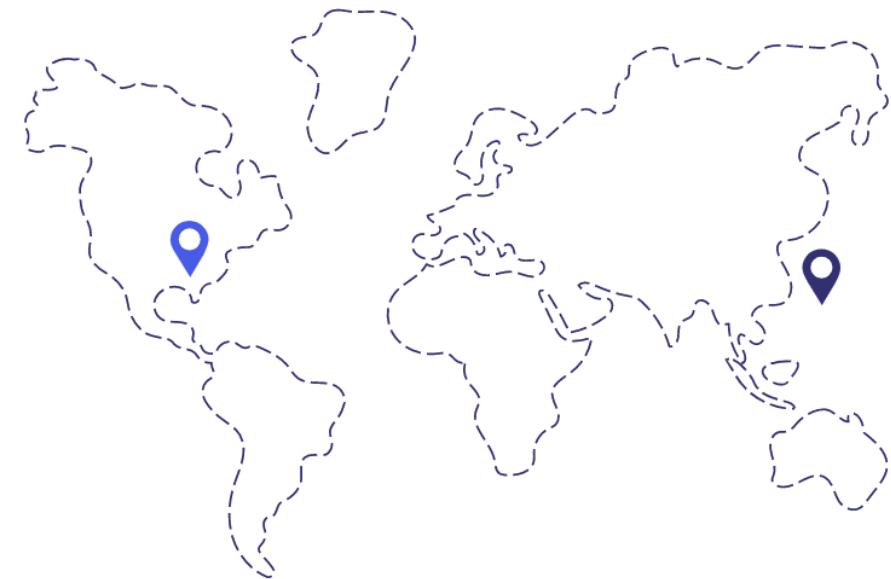
## Nat'l Taiwan University

MA, Linguistics  
BA, Foreign Languages



## Rice University

PhD, Linguistics  
MA, Linguistics



# Experience



## English lecturer

- at Nat'l Taipei U of Technology

**I LOVE GRAMMAR.**

**IT MAKES PEOPLE CRY.**

weknowmemes

# Experience



Postdoc  
researcher

- at Peking U



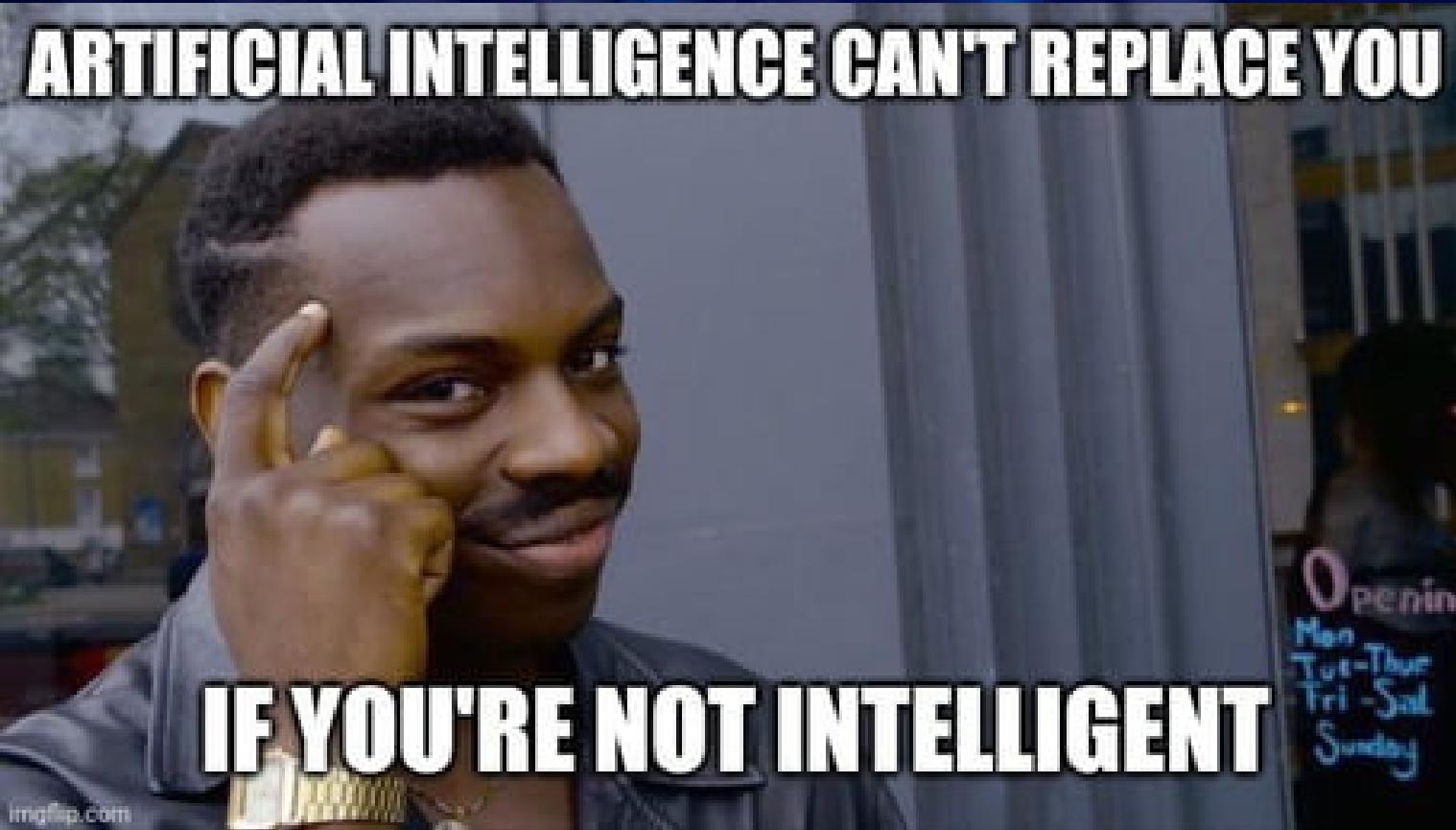
**ONE DOES NOT SIMPLY  
CHOOSE WHERE TO POSTDOC**

# Experience



AI engineer

- at Hamastar Tech
- at Wisers Information Limited



# Experience



Assistant  
manager of data  
analysis

- at Shin Kong Life

**YOU GOT INSURANCE FOR YOUR  
CAR**

**BUT NO LIFE INSURANCE FOR YOU  
AND YOUR FAMILY?**

[makeameme.org](http://makeameme.org)

# Intro to AI



# AI and its other names

## 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.

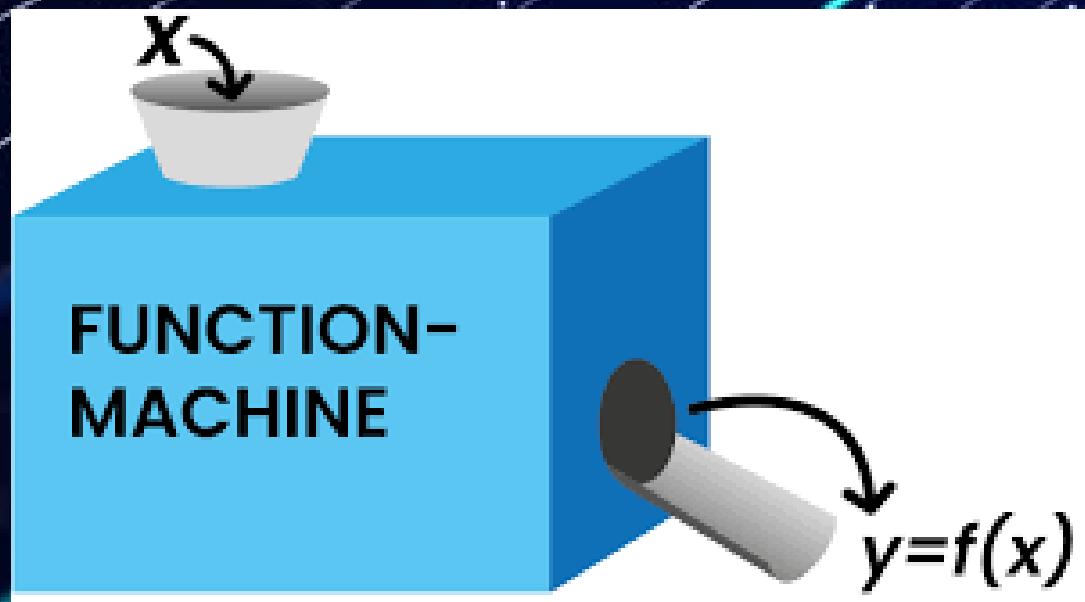


**Deep Learning**  
A subset of machine learning that focuses on neural networks with many layers.



# 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
- Programming

LIKE(I, languages)

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

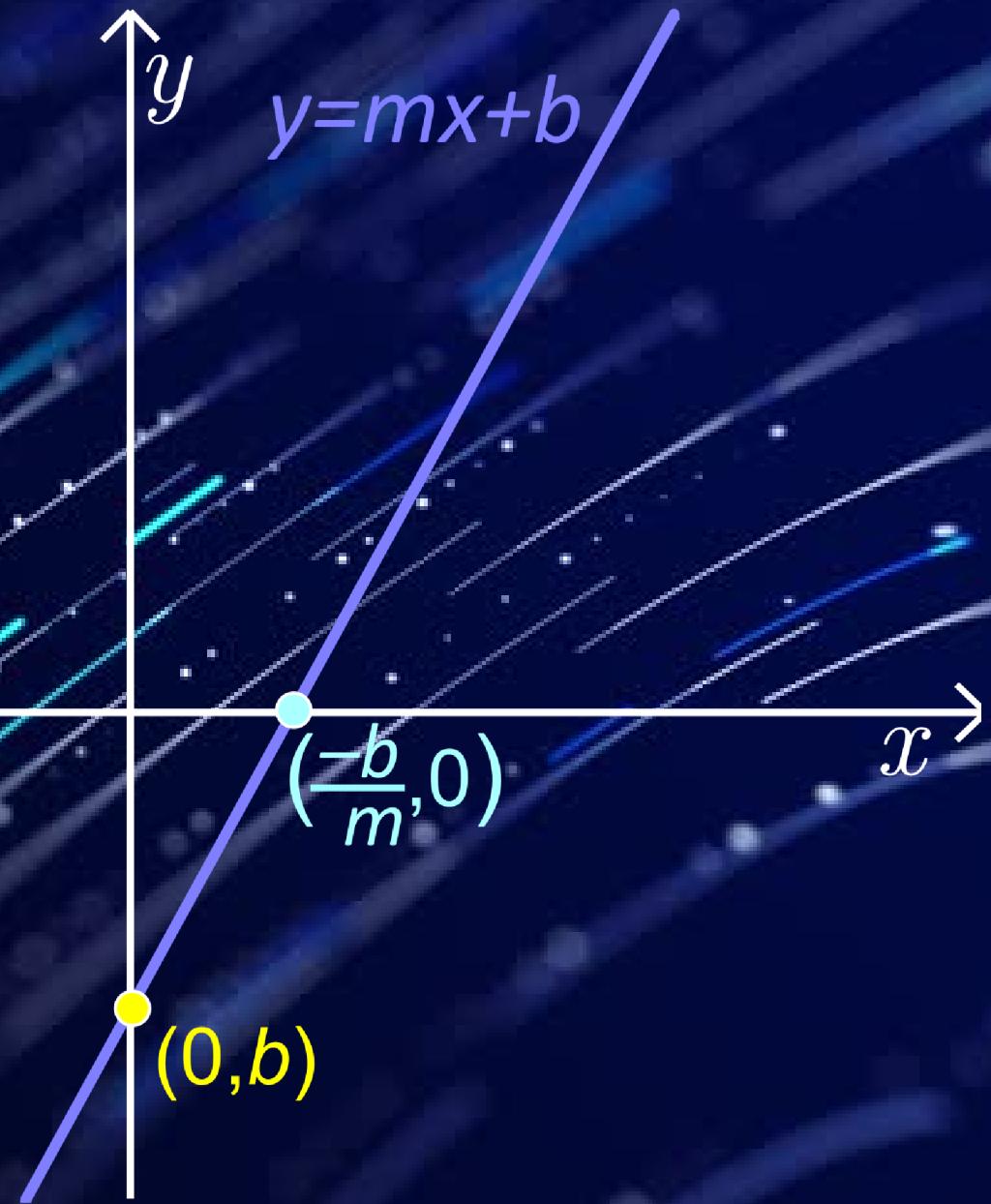
Try it out here!

# Data-driven AI

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

```
inputs = [2, 3, 4] # the x variable  
outputs = [12, 17, 22] # the y variable
```

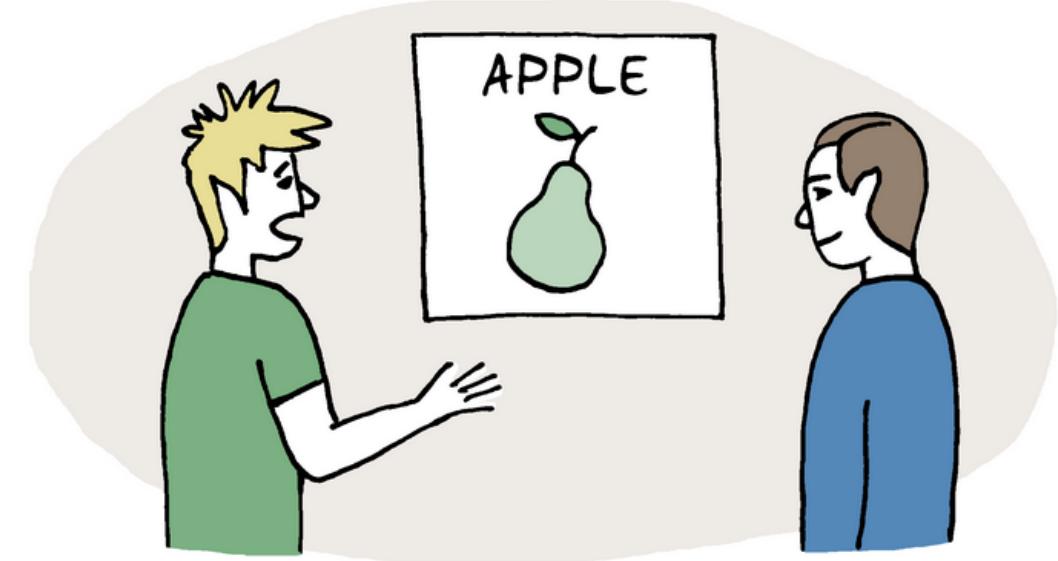
*Random :  $y = 0.1x + 5$*   
*> Trained :  $y = 5x + 2$*  ”



## How do machines learn?

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

## MACHINE LEARNING



WELL, A MORE ACCURATE  
NAME WOULD BE  
MACHINE GUESSING



Dataedo /cartoon

Piotr@Dataedo

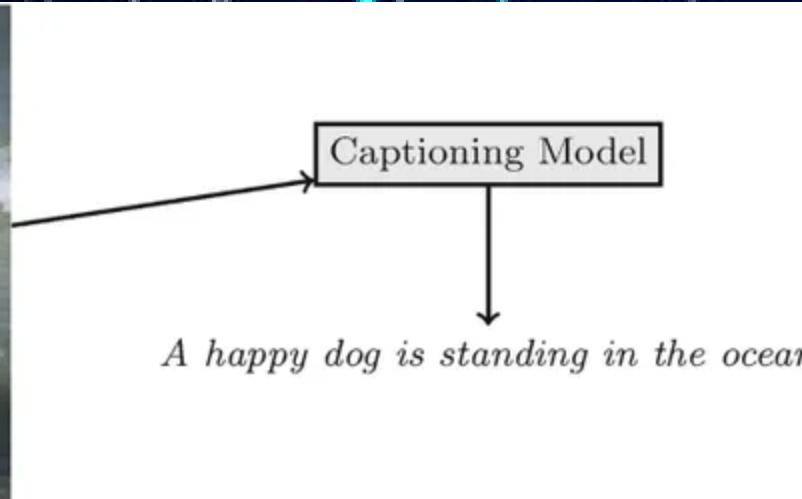
# Why is machine learning powerful?

“

True power of ML/DL

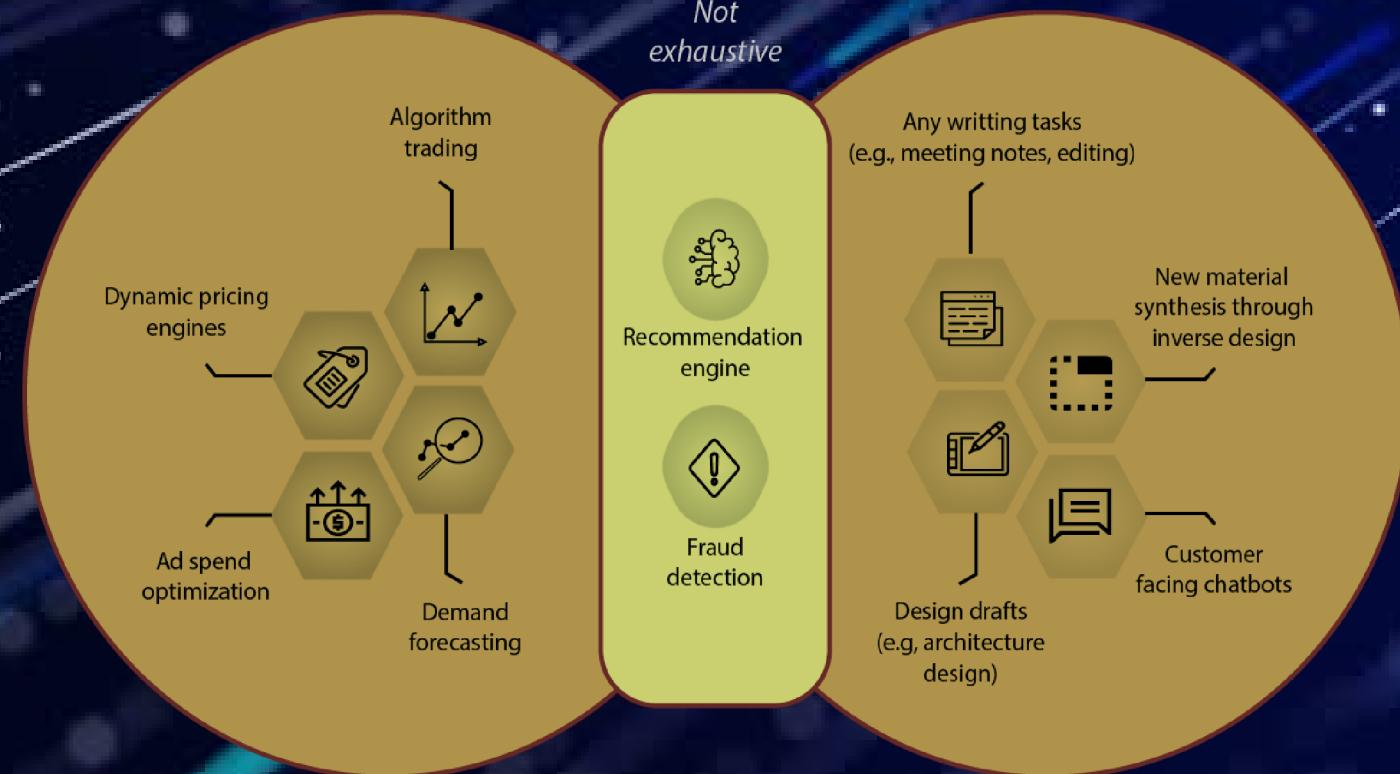
- humans only need to provide input and output
- computers are in charge of figuring out the right process (i.e. a model)

”



# 2 types of AI

## Discriminative uses of AI



# 2 types of discriminative models

## Regression



What will be the temperature tomorrow?

84°



Fahrenheit

## Classification

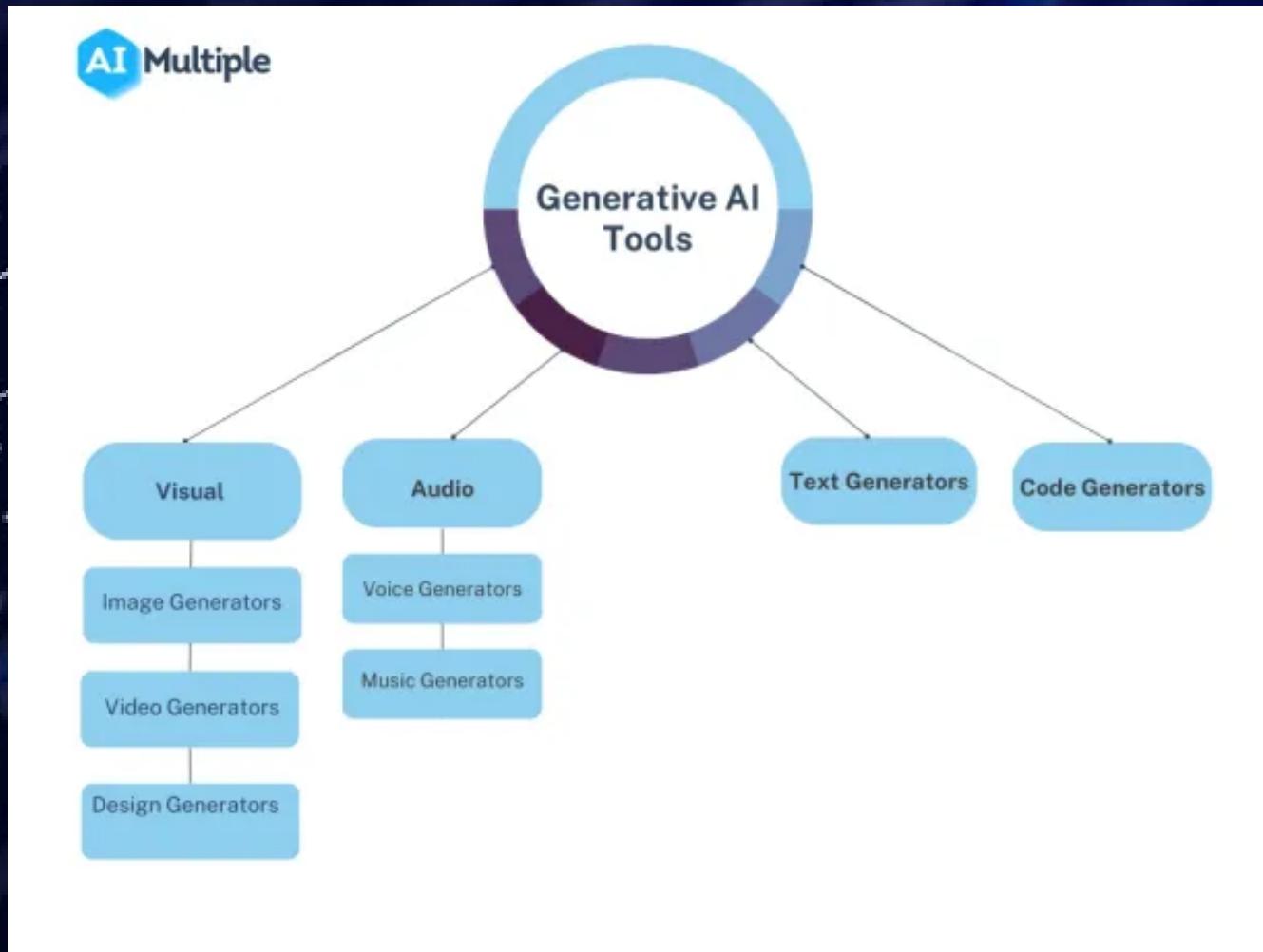


Will it be hot or cold tomorrow?



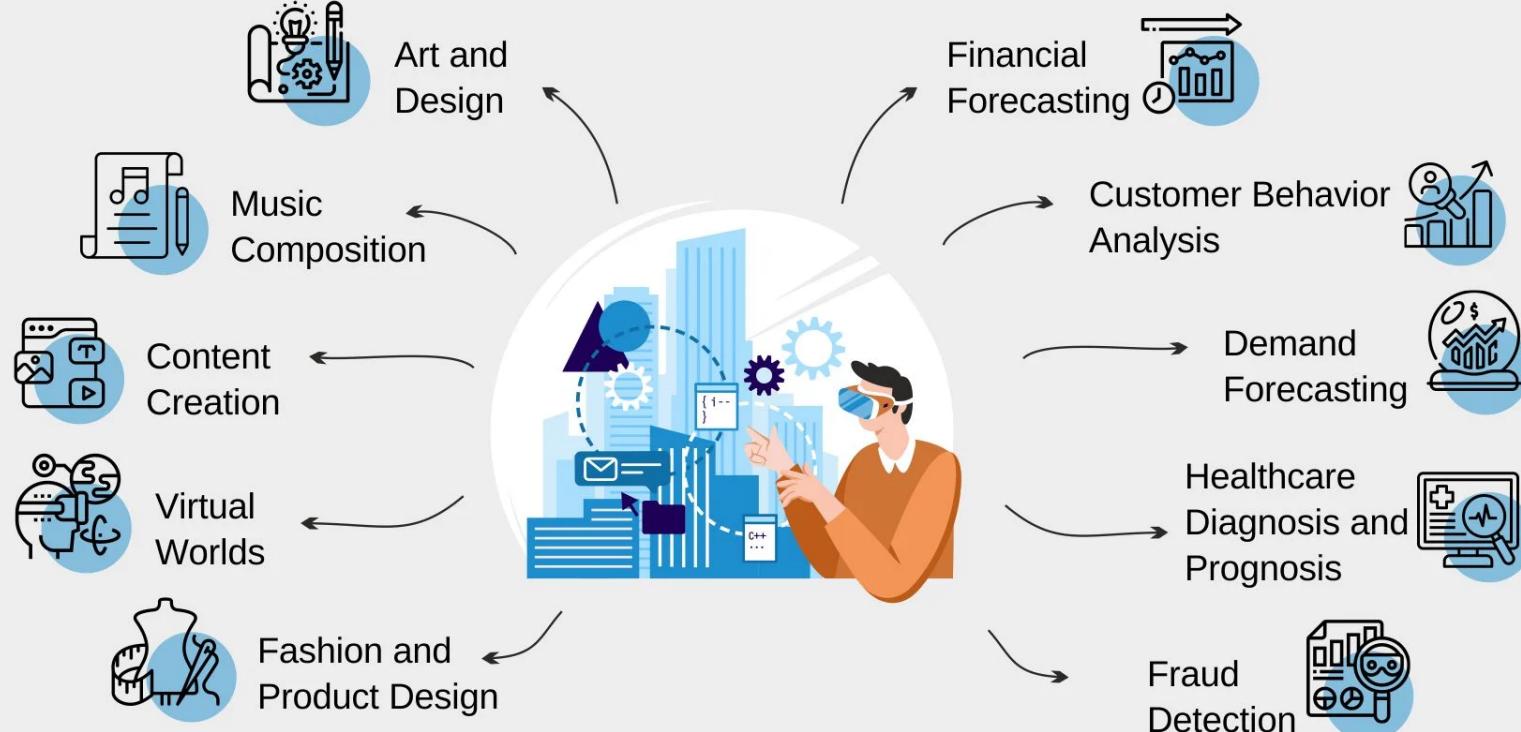
Fahrenheit

# 4 types of generative models

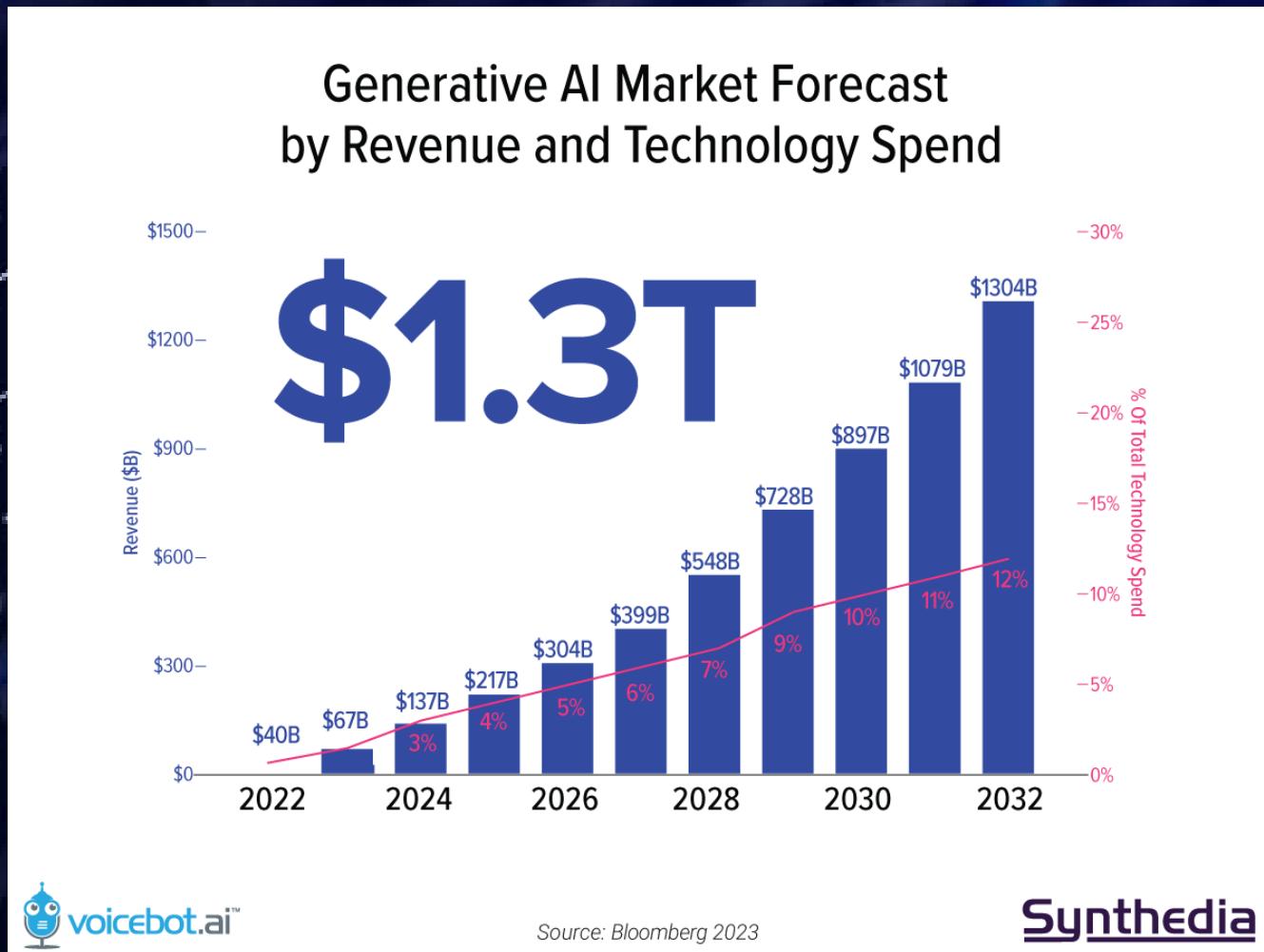


# Use cases of GenAI

## Generative AI Applications



# Revenue forecast of GenAI



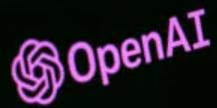
# Large Language Models

UNDERSTANDING THEIR IMPACT

## Exploring Large Language Models

# ChatGPT's status

“ The New York Times  
The best artificial intelligence chatbot ever released to the general public. ”



## ChatGPT: Optimizing Language Models for Dialogue

We've trained a model called ChatGPT which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer followup questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests. ChatGPT is a sibling model to InstructGPT, which is designed to follow an instruction in a prompt and provide a response.

# ChatGPT's significance

“

TechGoing

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

~ Bill Gates

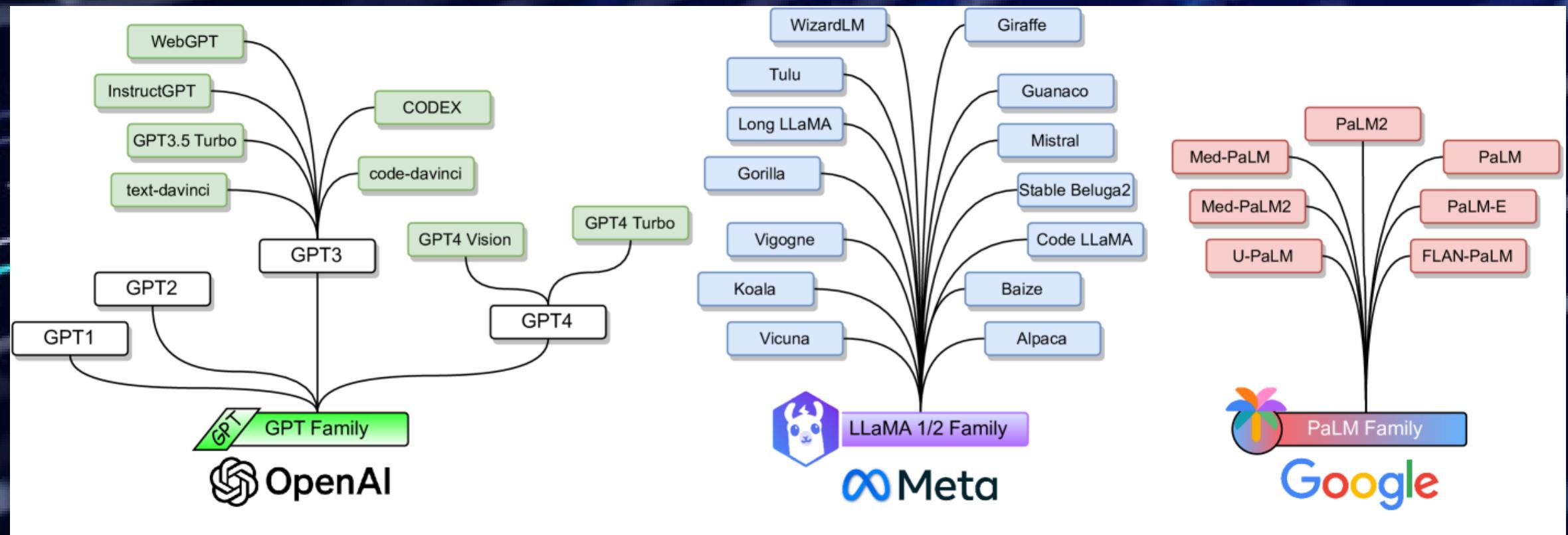


# ChatGPT's model

“

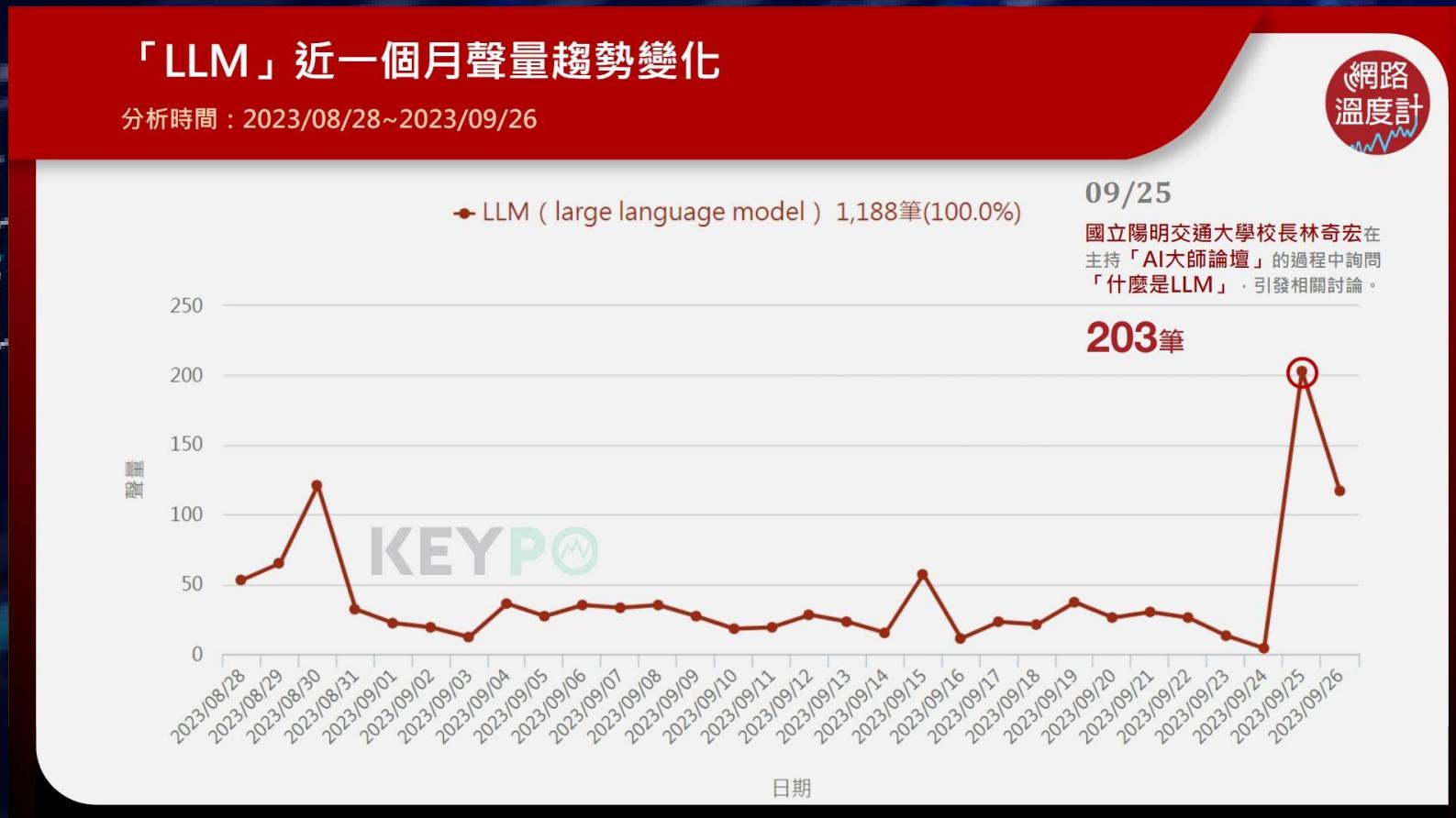
ChatGPT  
is powered by a large  
language model (LLM) called  
Generative Pre-trained  
Transformer (GPT).

# The LLM family



# Trends of LLM

- LLM became a popular term in Taiwan around Sep, 2023.



# What makes LLM large?

“

LLM

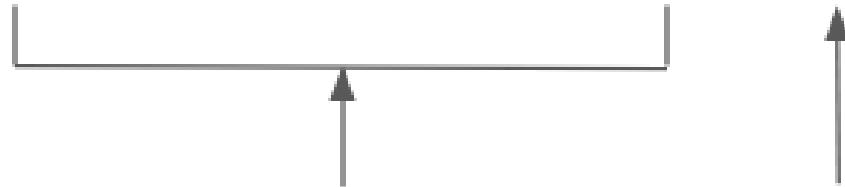
- is large because of the size of its parameters.
- Recall that  $y = 0.1x + 5$  has one parameter.

”

# What is a language model?

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

$S = \text{Where are we going}$

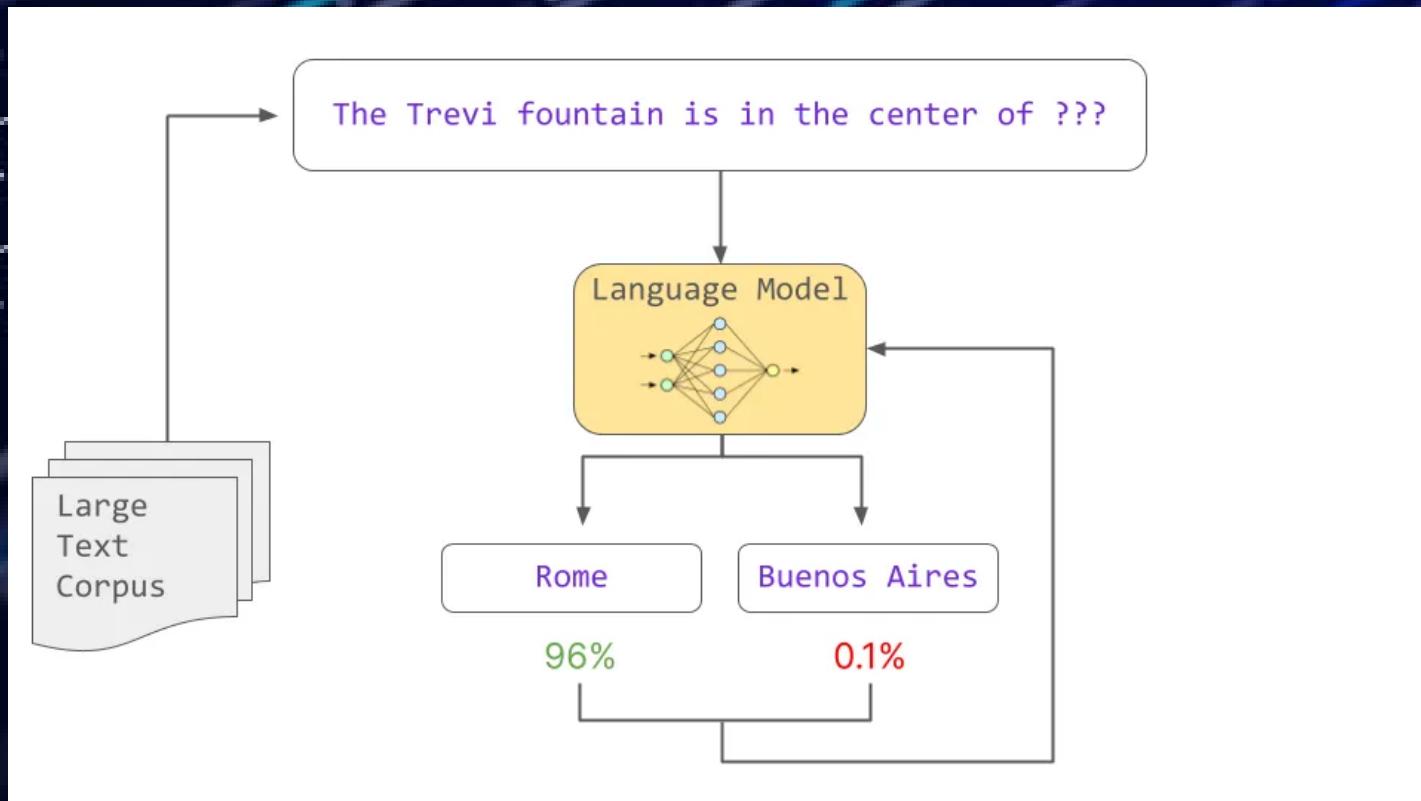


Previous words  
(Context)      Word being  
predicted

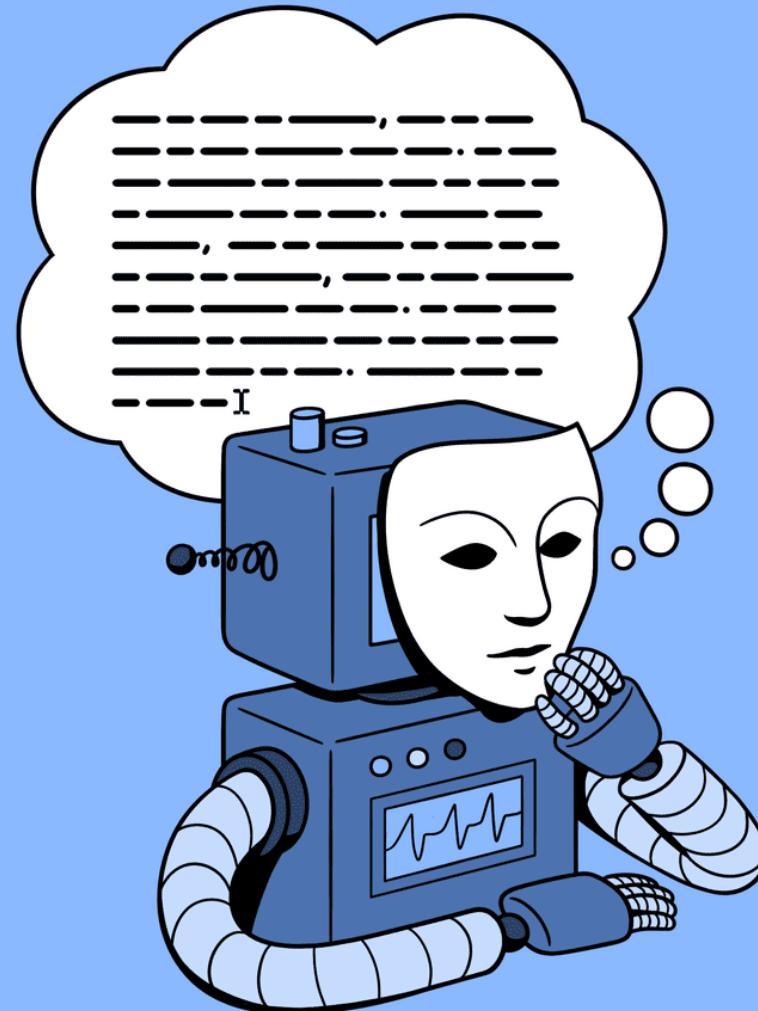
$$P(S) = P(\text{Where}) \times P(\text{are} \mid \text{Where}) \times P(\text{we} \mid \text{Where are}) \times P(\text{going} \mid \text{Where are we})$$

# A language model has some world knowledge.

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



# Definition



## Large Language Model (LLM)

[lärj 'laŋ-gwij 'mä-dəl]

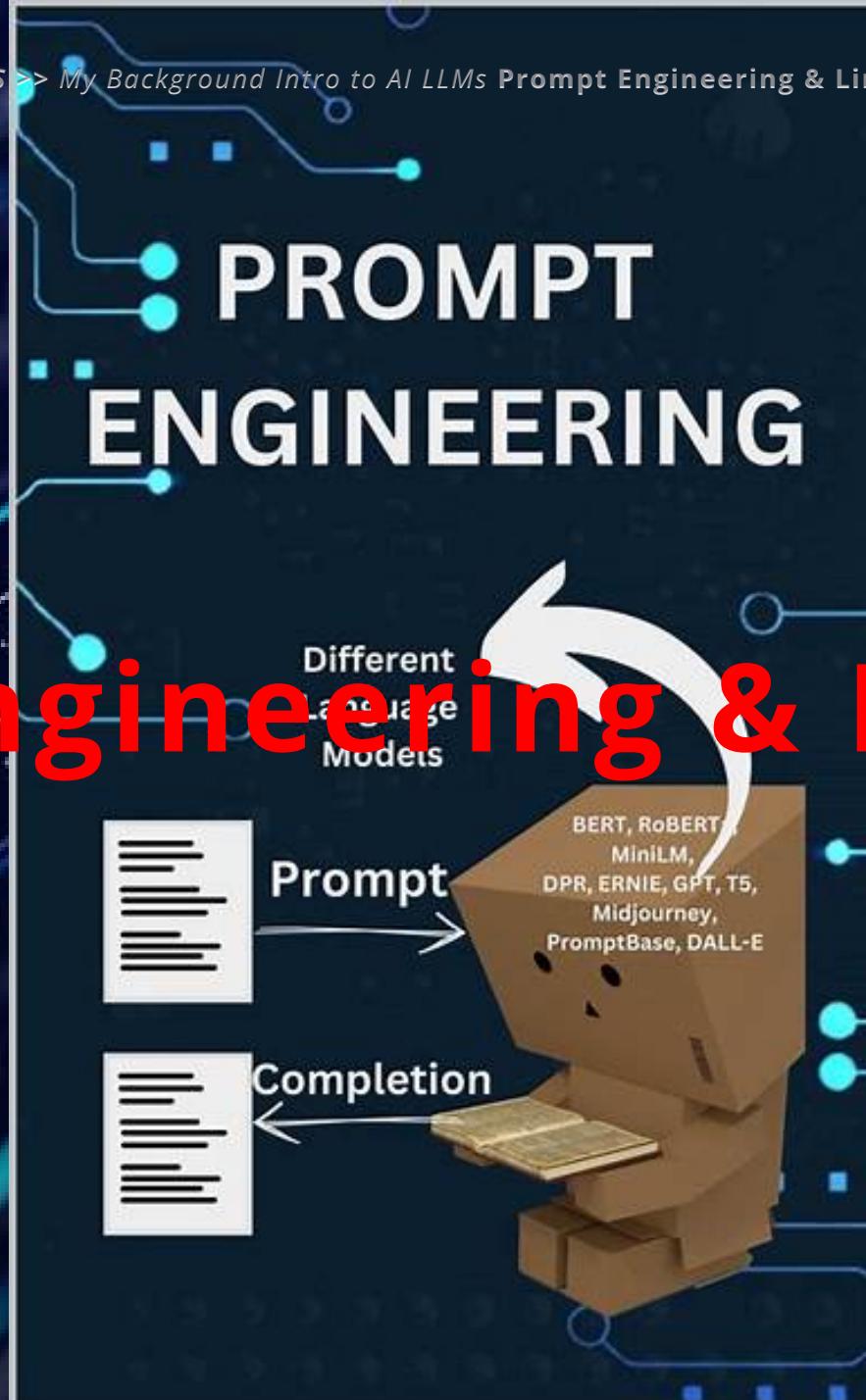
A deep learning algorithm that's equipped to summarize, translate, predict, and generate human-sounding text to convey ideas and concepts.

# Top AI chatbots in 2024 powered by LLM

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

Source

# Prompt Engineering & Linguistics



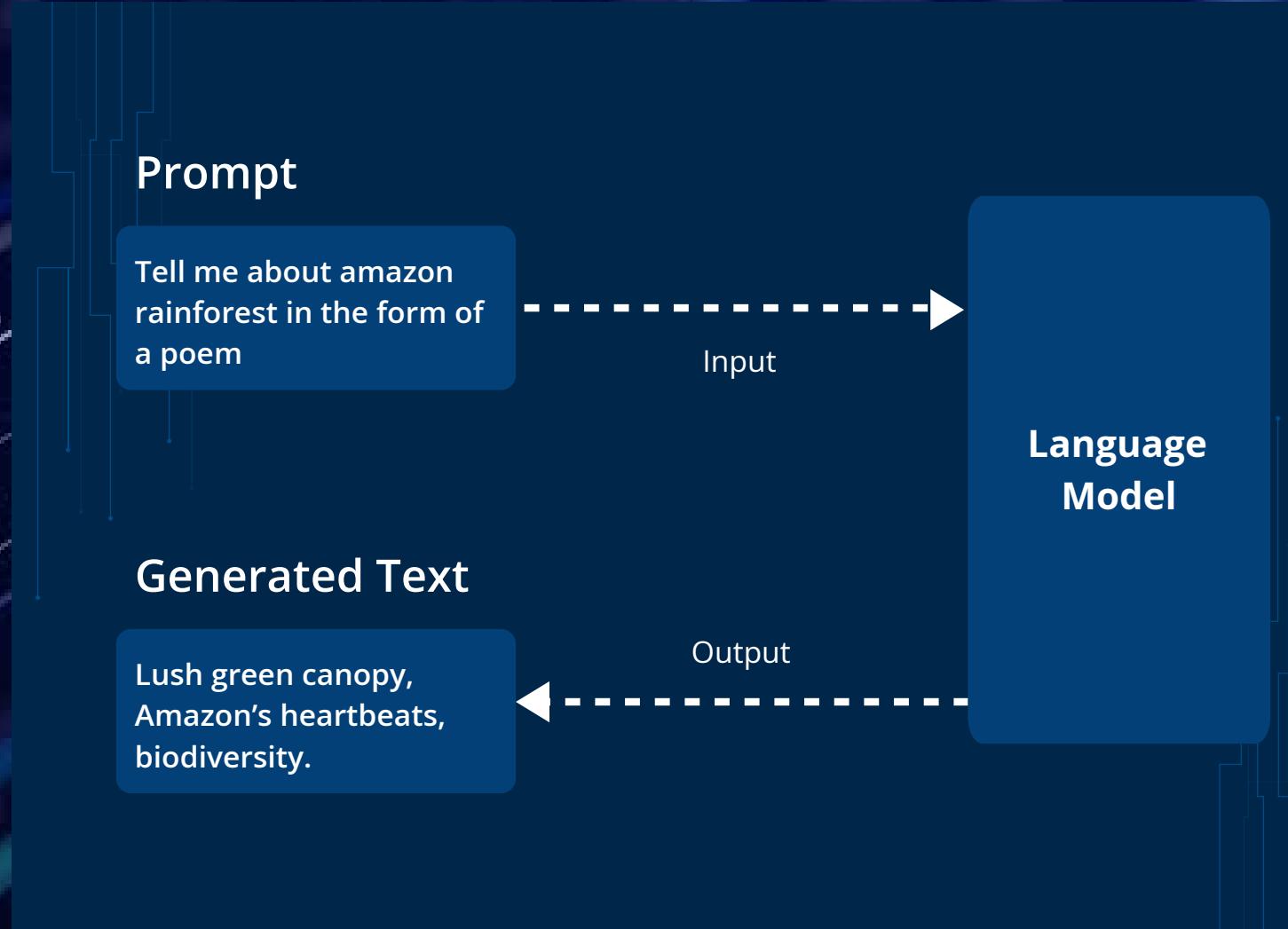
# Prompt on the terminal

```
tvanantwerp@Toms-iMac: ~ (zsh)
tvanantwerp@Toms-iMac.local
OS: macOS 10.14.5 18F132 x86_64
Host: iMac18,3
Kernel: 18.6.0
Uptime: 3 hours, 31 mins
Packages: 189
Shell: zsh 5.3
Resolution: 2560x1440@2x, 1440x2560@2x, 1440x2560@2x
DE: Aqua
WM: Quartz Compositor
WM Theme: Blue (Dark)
Terminal: iTerm2
Terminal Font: DroidSansMonoNerdFontComplete- 14
CPU: Intel i7-7700K (8) @ 4.20GHz
GPU: Radeon Pro 580
Memory: 6006MiB / 16384MiB
```

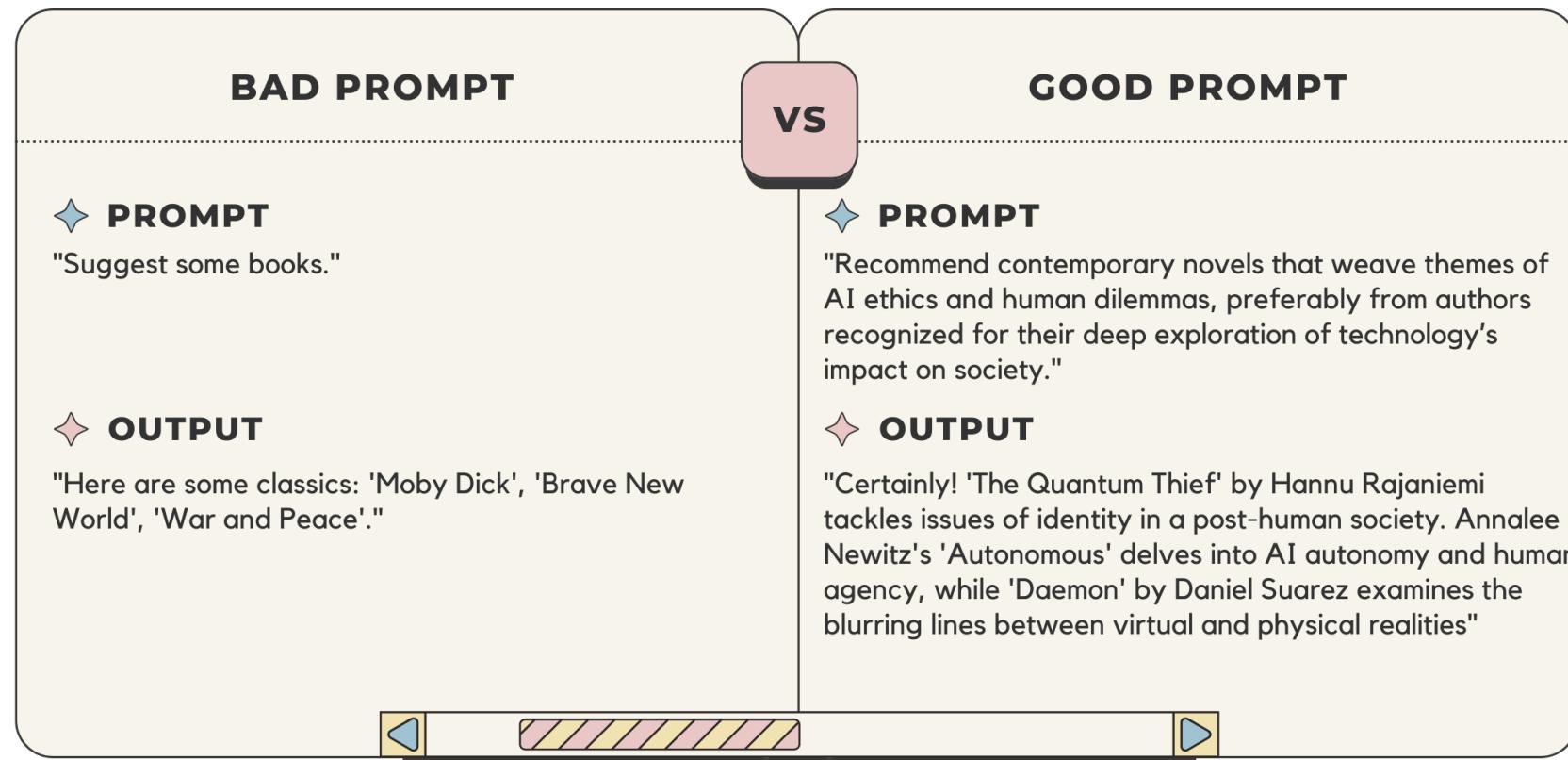
11.06.19 ⌂ 12:40:05

# Prompt in GenAI

“  
Prompt  
In the context of  
GenAI, a prompt  
is a specific  
instruction or  
input given to  
the AI model to  
generate a  
desired output.”

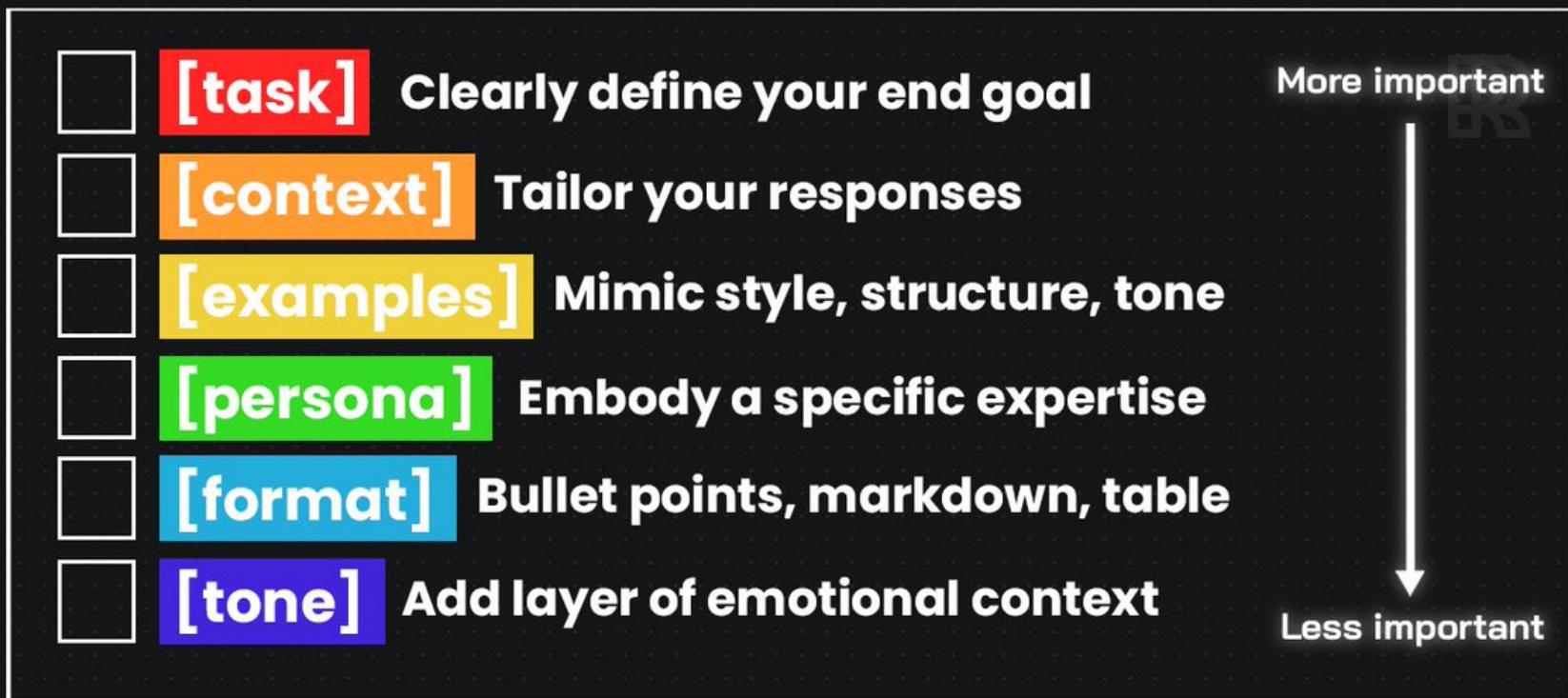


# What makes a good prompt?



# Elements of a good prompt

## The 6-Step Prompt Checklist

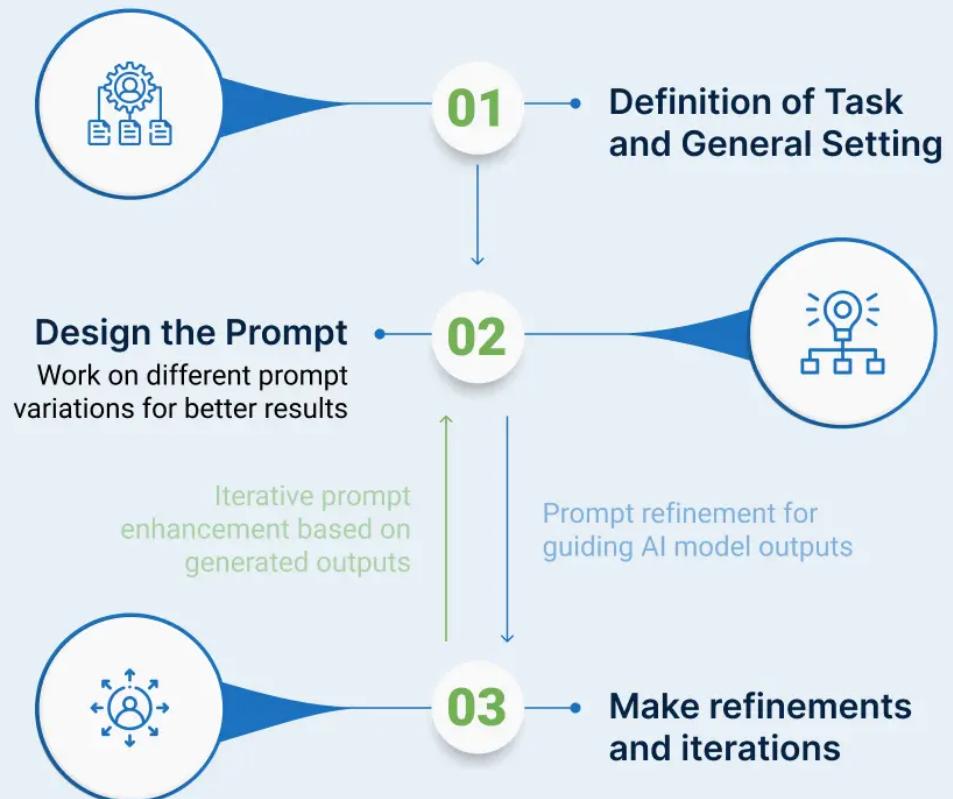


[www.therundown.ai](http://www.therundown.ai)

## What is prompt engineering?

“ Prompt Engineering is the process of designing, testing, and optimizing prompts that are used to instruct AI models to perform specific tasks. ”

## Prompt Engineering Process



SERPSTAT

Who are Prompt Engineers, and Why Hire a Prompt Engineering Master?

# About prompt engineers

## 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

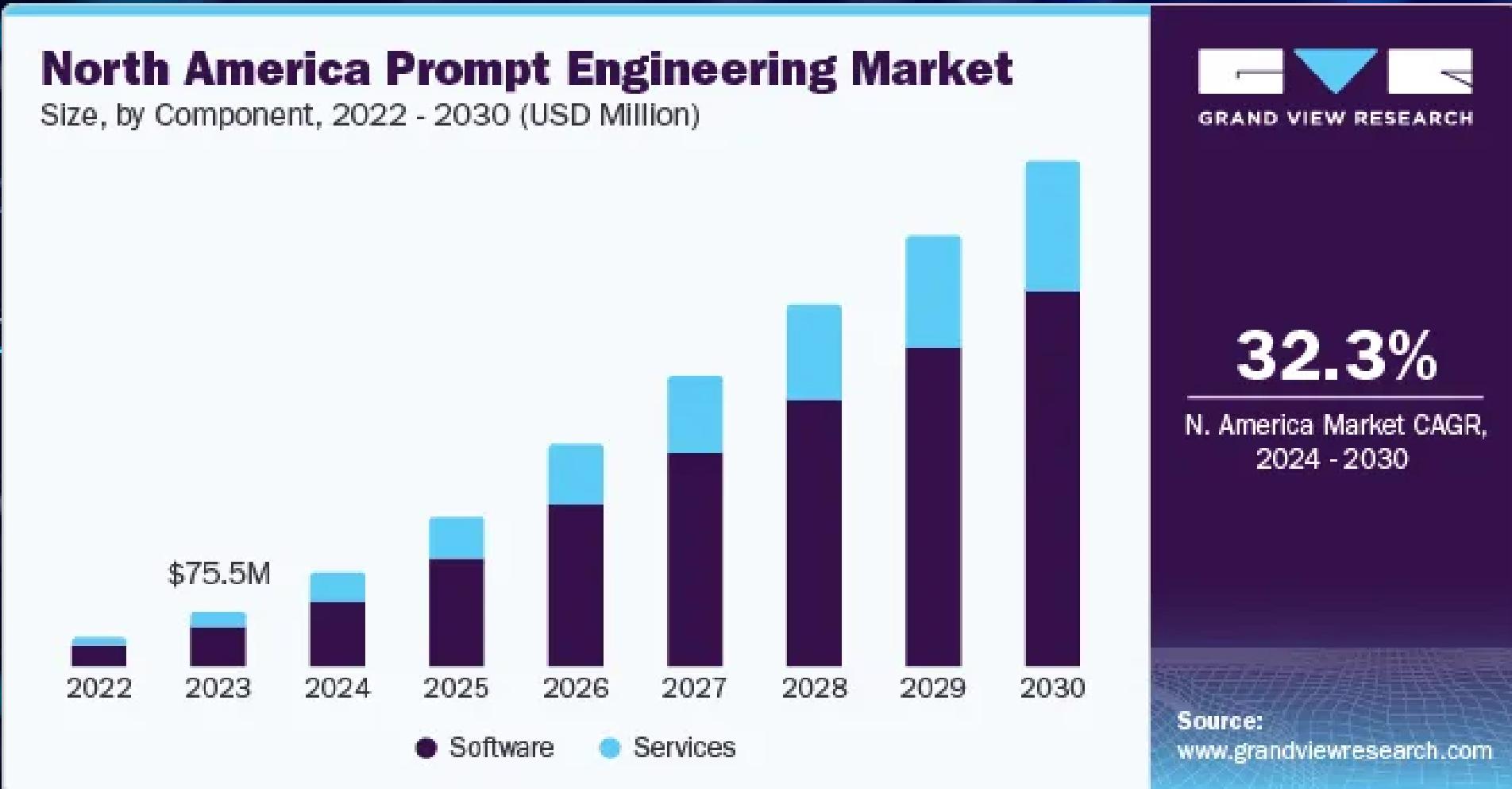
### Skills

- 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 highly valued.



# Prompt engineers are in high demand.

# Benefits and requirements of prompt engineers

Original post



[twitter.com/AiBreakfast/status/1625594172815339521](https://twitter.com/AiBreakfast/status/1625594172815339521)



← Post



AI Breakfast ✅

@AiBreakfast

Wow - Anthropic (Google's latest \$300M AI investment) is hiring a "Prompt Engineer" for \$250k-\$335k/yr + equity

No CS degree required, just have "at least basic programming and QA skills"

Wild times.

#### Representative Projects

- Discover, test, and document best practices for a wide range of tasks relevant to our customers.
- Build up a library of high quality prompts or prompt chains to accomplish a variety of tasks, with an easy guide to help users search for the one that meets their needs.
- Build a set of tutorials and interactive tools that teach the art of prompt engineering to our customers.

#### You may be a good fit if you:

- Have a creative hacker spirit and love solving puzzles.
- Are an excellent communicator, and love teaching technical concepts and creating high quality documentation that helps out others.

**Prompt  
engineering  
requires  
soft skills.**

## 5 non-tech prompt engineering skills



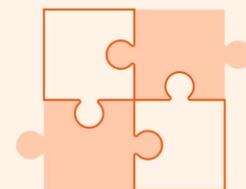
Language



Communication



Creativity



Critical thinking



Subject matter expertise

**zapier**

# Prompt engineering skill - language

Linguistics,

the scientific study of language and its structure, plays a vital role in prompt engineering. It helps in:

1. **Understanding 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.

”

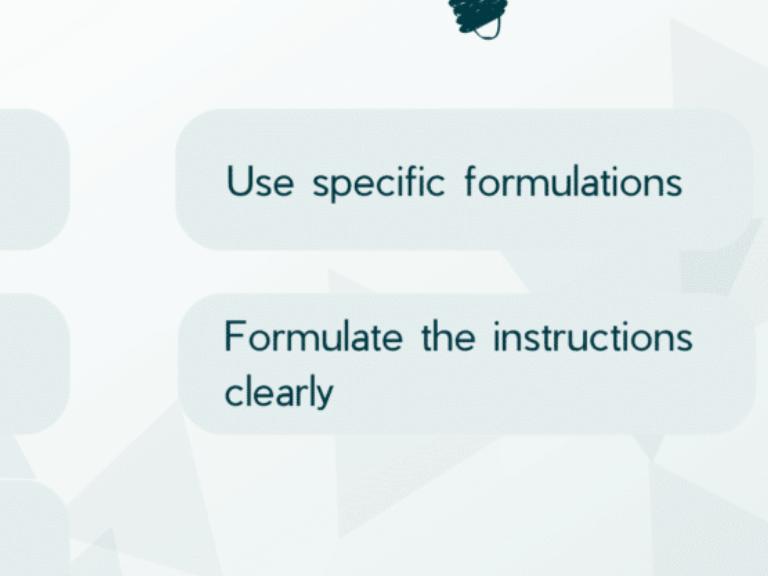
# Prompt engineering skill - language

## Prompt Engineering

**How to structure Prompts:**

- Specify the scenario
- Assign a role in the instruction
- Provide the model with additional information
- Use specific formulations
- Formulate the instructions clearly

**ELEVATE X**  
Unleashing the power of freelancing



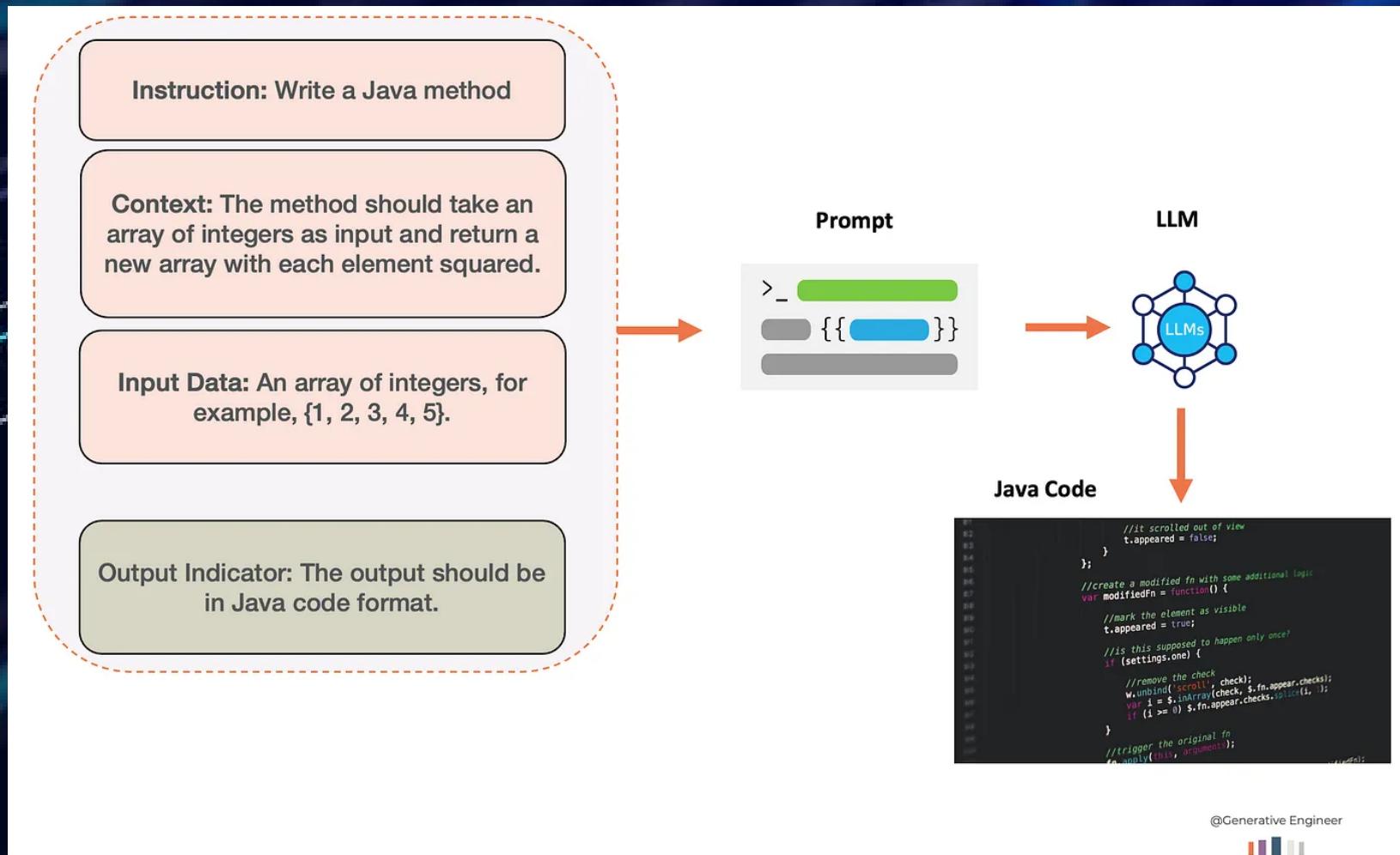
# Prompt engineering skill - critical thinking

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

@GenerativeEngineer



# Prompt engineering skill - coding



# English as the most powerful programming language

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

Member-only story

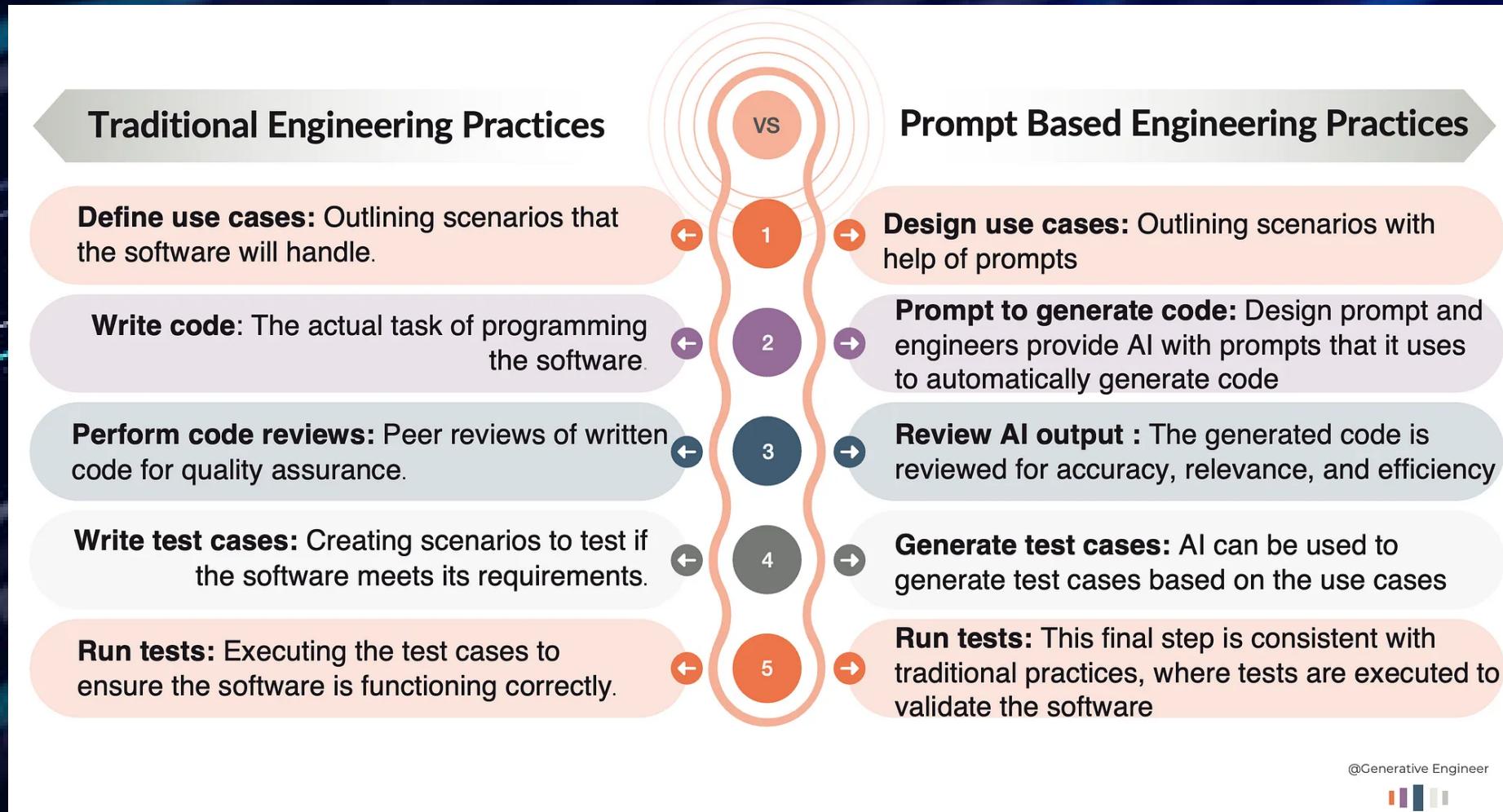
## English is the most powerful programming language — even for data science: Introduction to prompt engineering

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

Source

# GenAI creates engineering paradigm shift.



@Generative Engineer



Start with  
Python  if you  
wanna try  
programming.

MARTIN WEISSE

# Python Programming for Linguistics and Digital Humanities

APPLICATIONS FOR TEXT-FOCUSED FIELDS



WILEY Blackwell

## 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 and common sense

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

- Try it out [here!](#)

# Outcome of the extraction

The interface displays three tokens with their grammatical relations:

- LIKE\_NUM**: POSITIVE NUMBER, marked with a green checkmark.
- POS**: ADJECTIVE (ADJ).
- OP**: UNKNOWN (??).

**NOUN**: NOUN.

**OP**: PLUS (+).

**add attribute** and **add token** buttons are present at the bottom.

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.

# 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!**

# 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

3 points

- **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.
- **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.
- **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](mailto:howard.haowen@gmail.com)
- Webpage:  
<https://howard-haowen.github.io>