

# 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



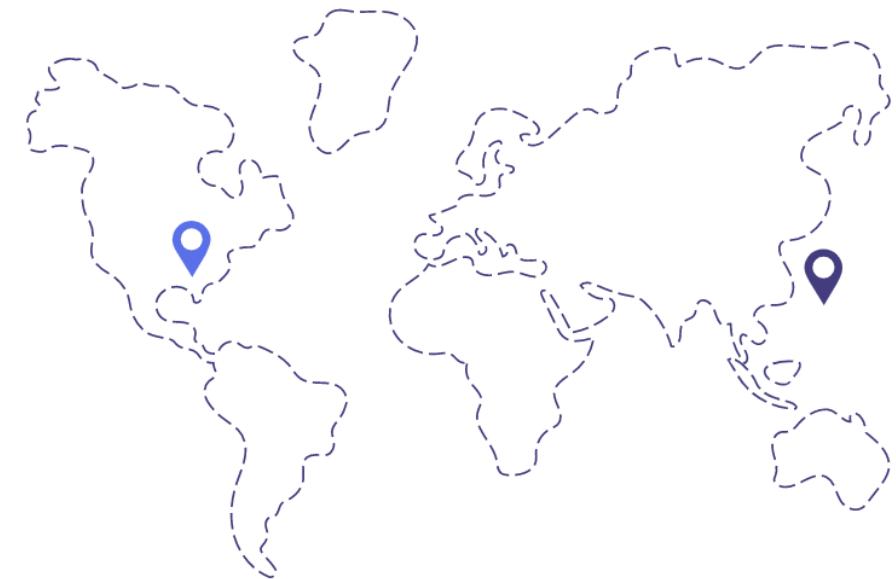
## Nat'l Taiwan University

MA, Linguistics  
BA, Foreign Languages



## Rice University

PhD, Linguistics  
MA, Linguistics



# Experience



English lecturer

- at Nat'l Taipei U of Technology

I LOVE GRAMMAR.

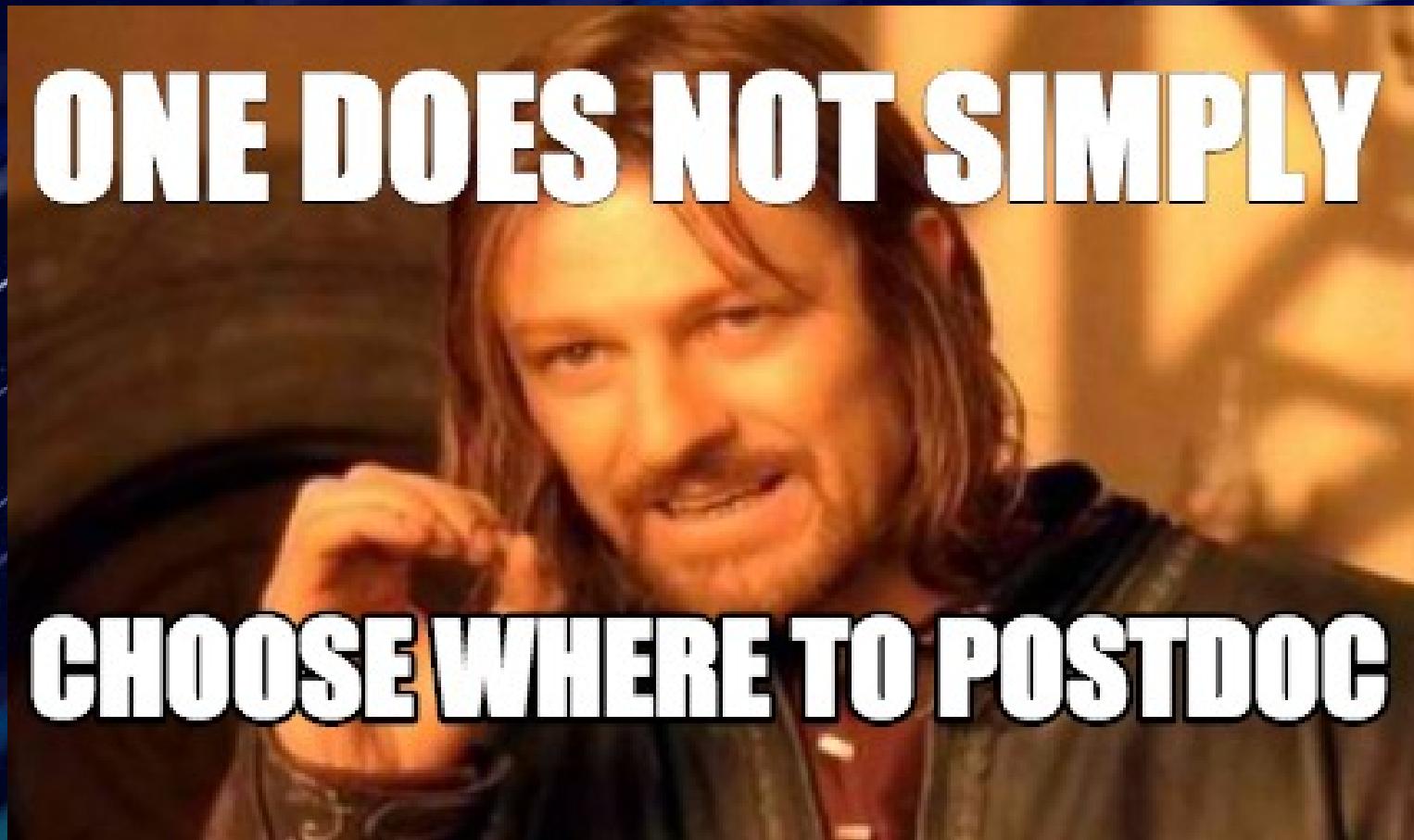
IT MAKES PEOPLE CRY.

weknowmemes

# Experience

👤 Postdoc  
researcher

- at Peking U

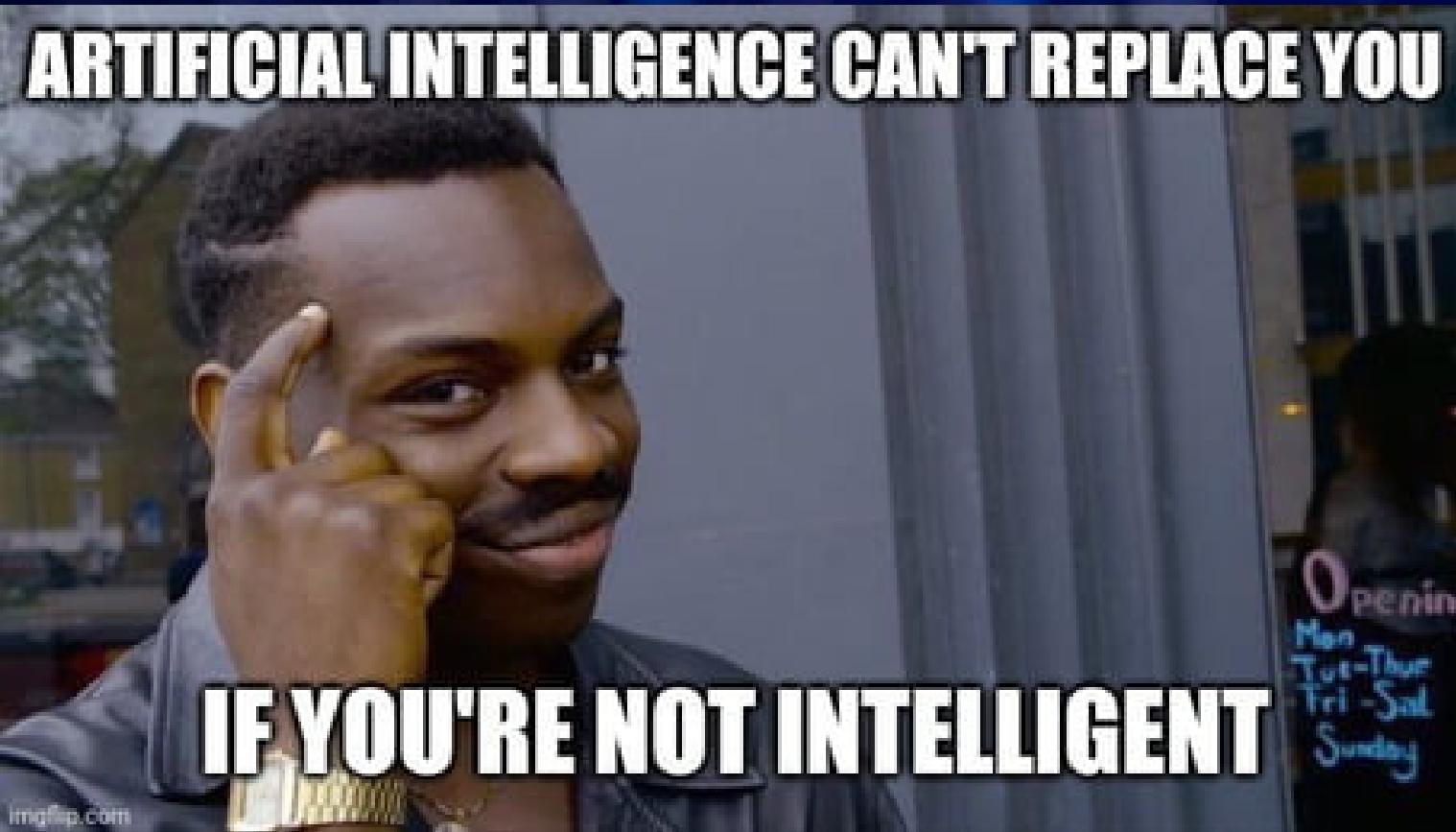


# Experience



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?**

# 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.

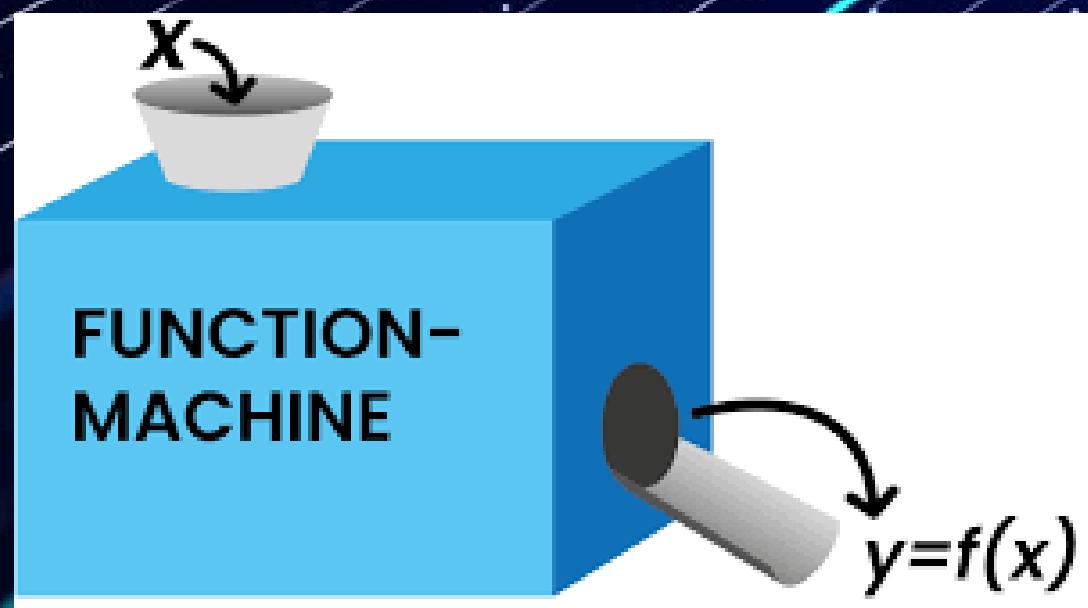


**Deep Learning**  
A subset of machine learning that focuses on neural networks with many layers.



# 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")
```

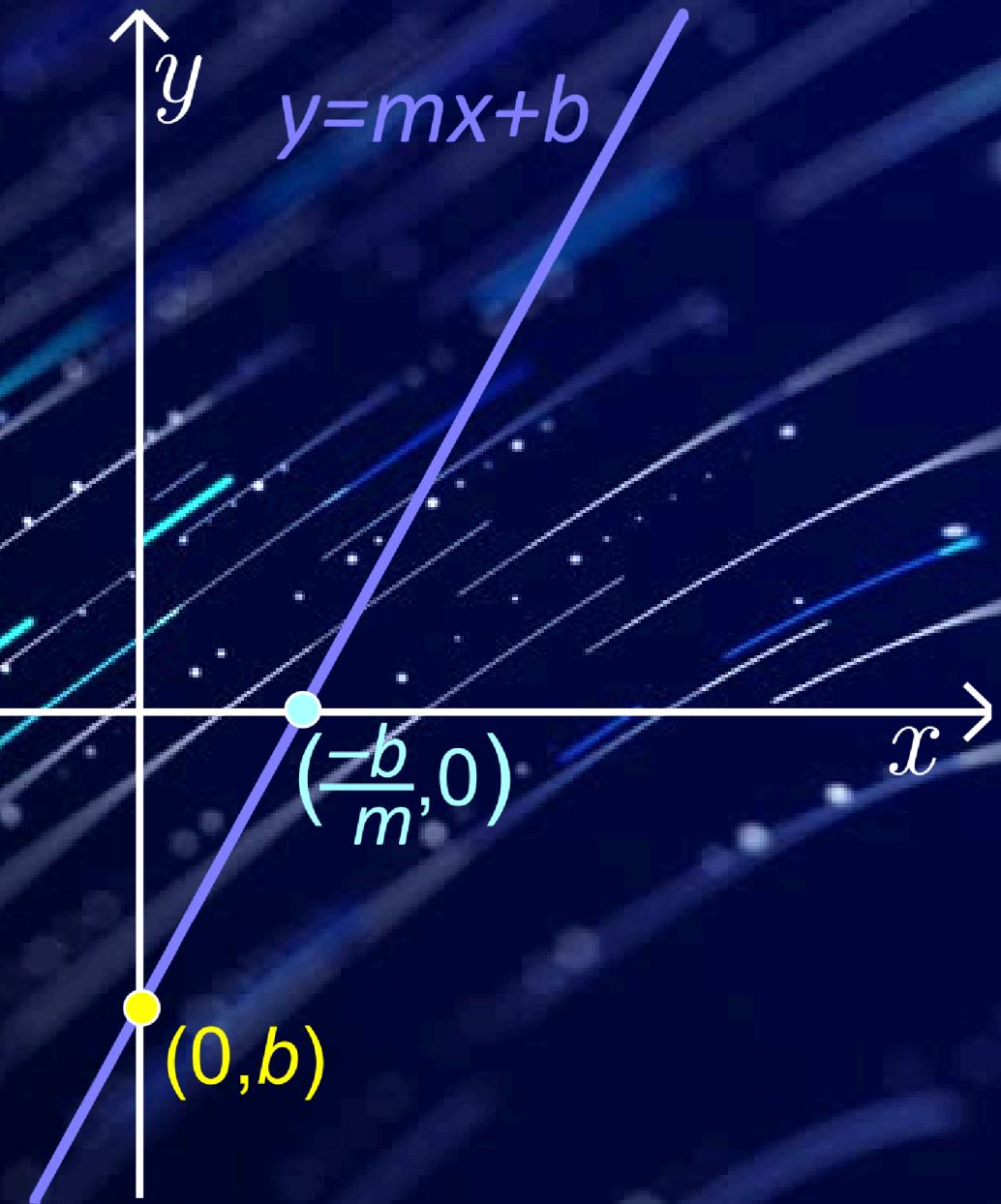
Try it out [here!](#)

# 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
```

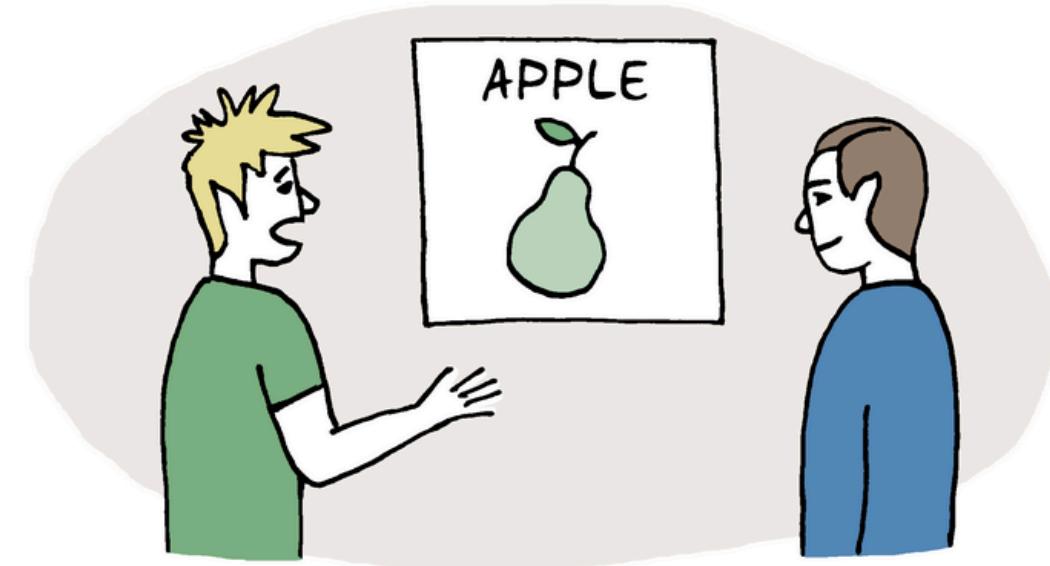
*Random :  $y = 0.1x + 5$*   
*> Trained :  $y = 5x + 2$*  ”



## 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

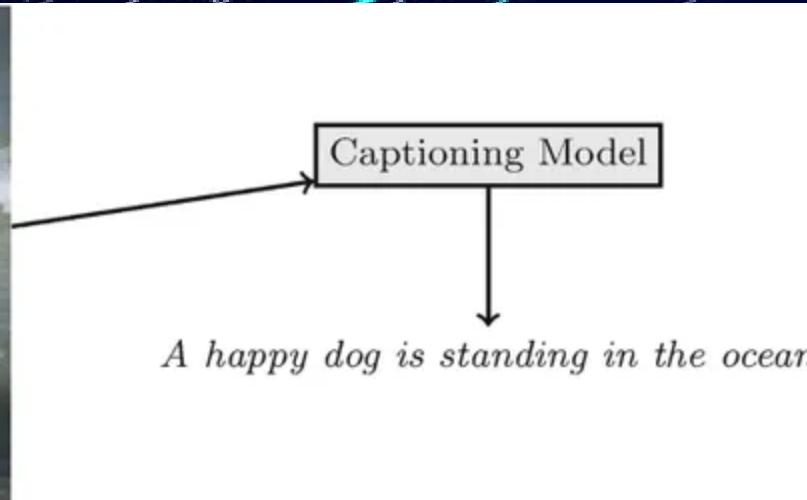
# Why is machine learning powerful?

“

True power of ML/DL

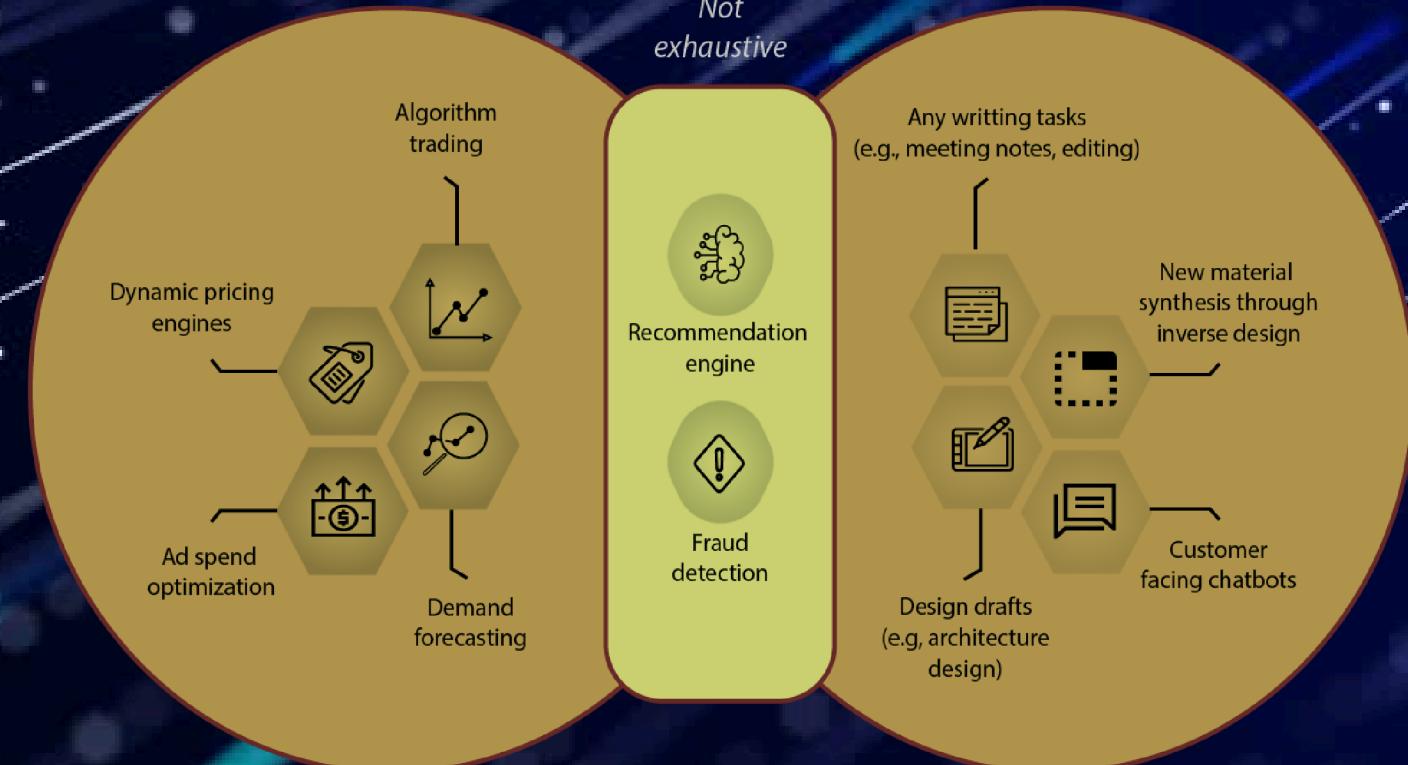
- humans only need to provide input and output
- computers are in charge of figuring out the right process (i.e. a model)

”



# 2 types of AI

## Discriminative uses of AI



# 2 types of discriminative models

## Regression



What will be the temperature tomorrow?



Fahrenheit

## Classification

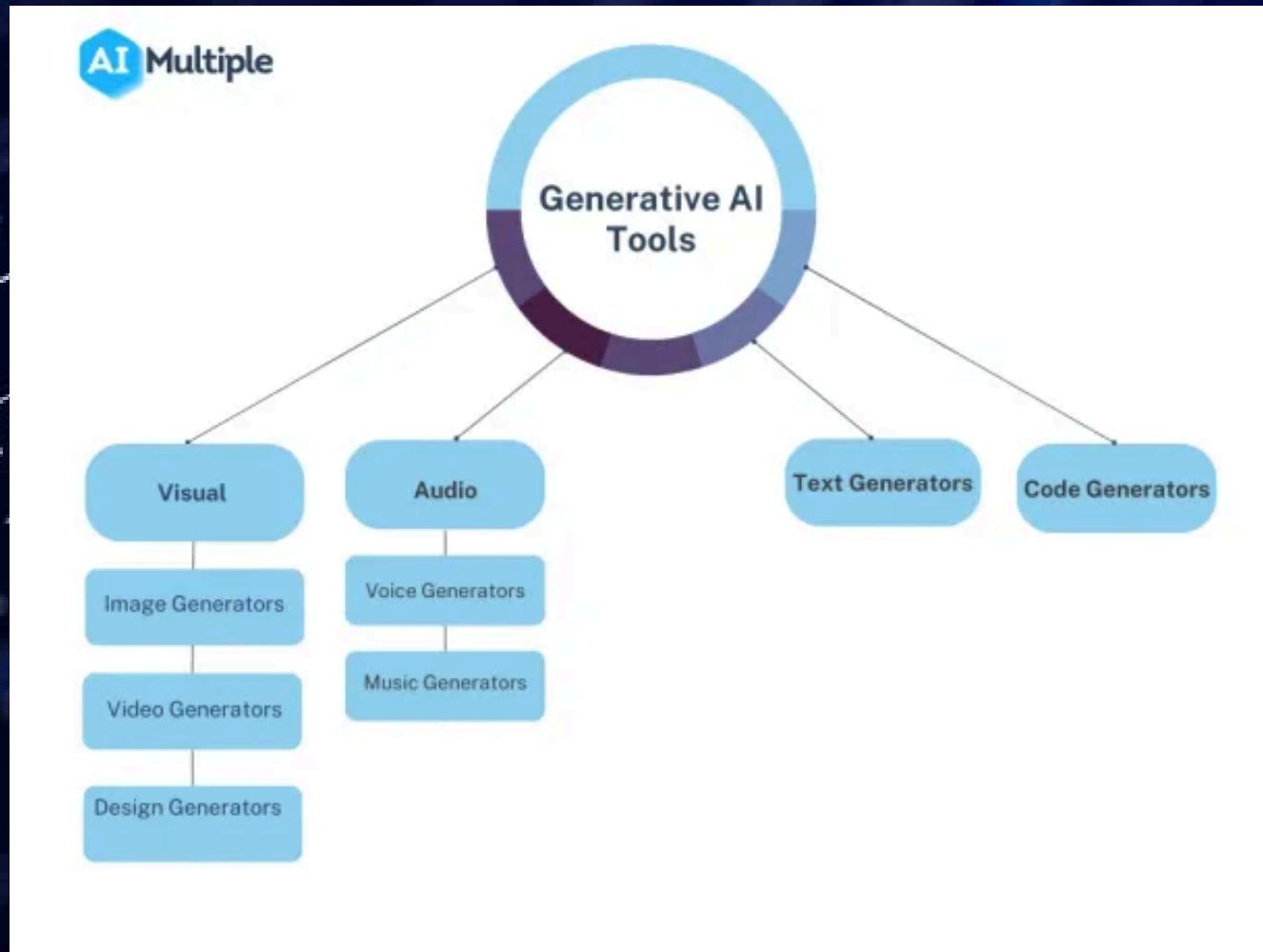


Will it be hot or cold tomorrow?



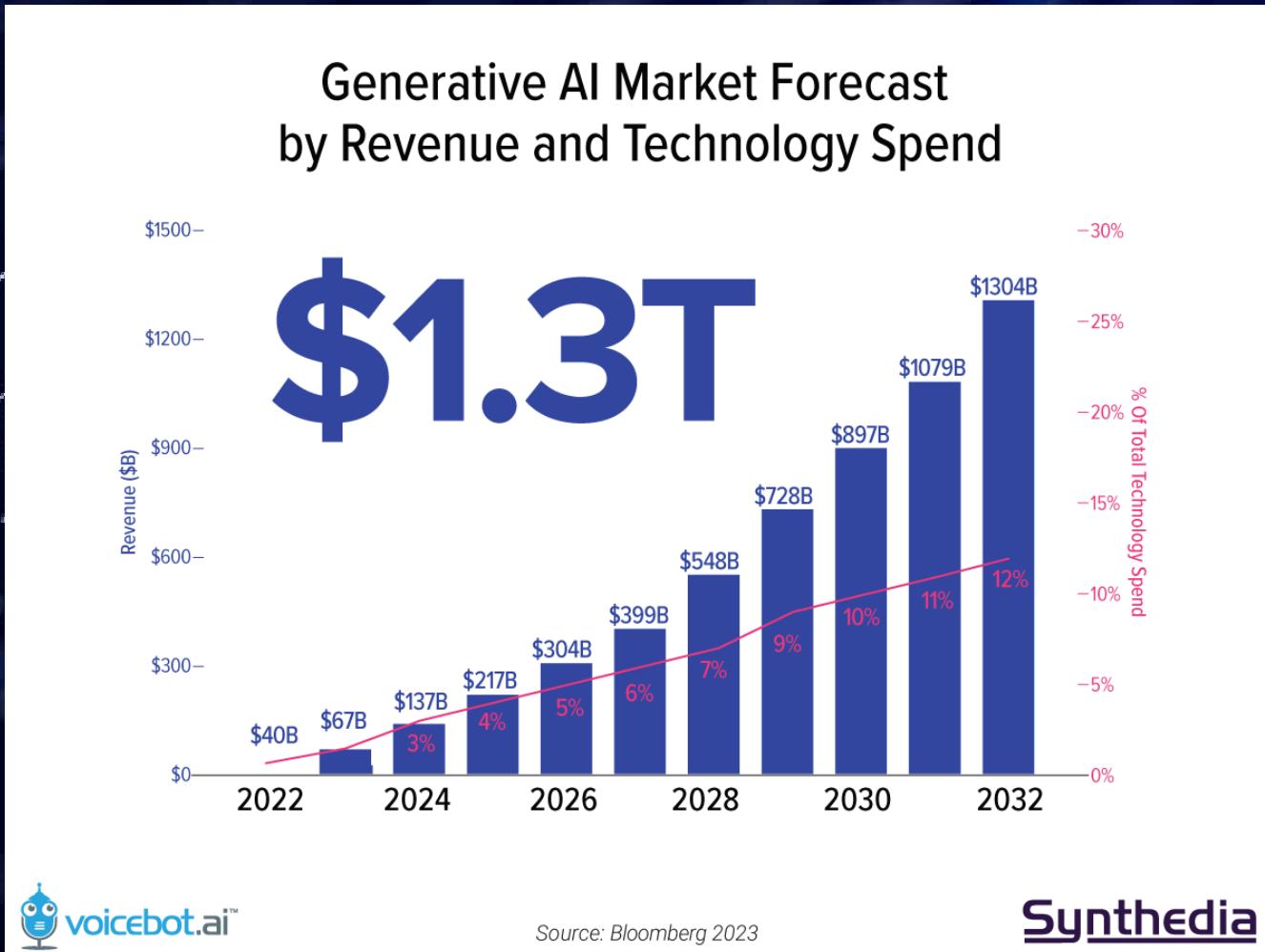
Fahrenheit

# 4 types of generative models



# Use cases of GenAI

# 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 trained 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

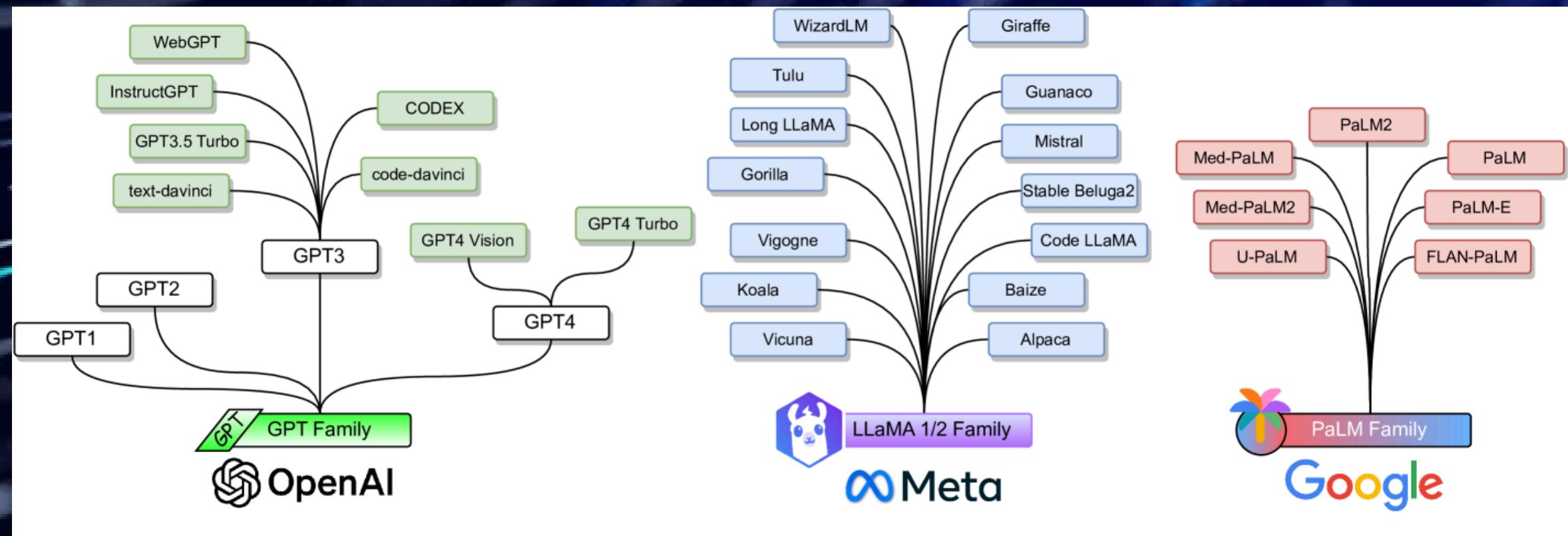
66

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.



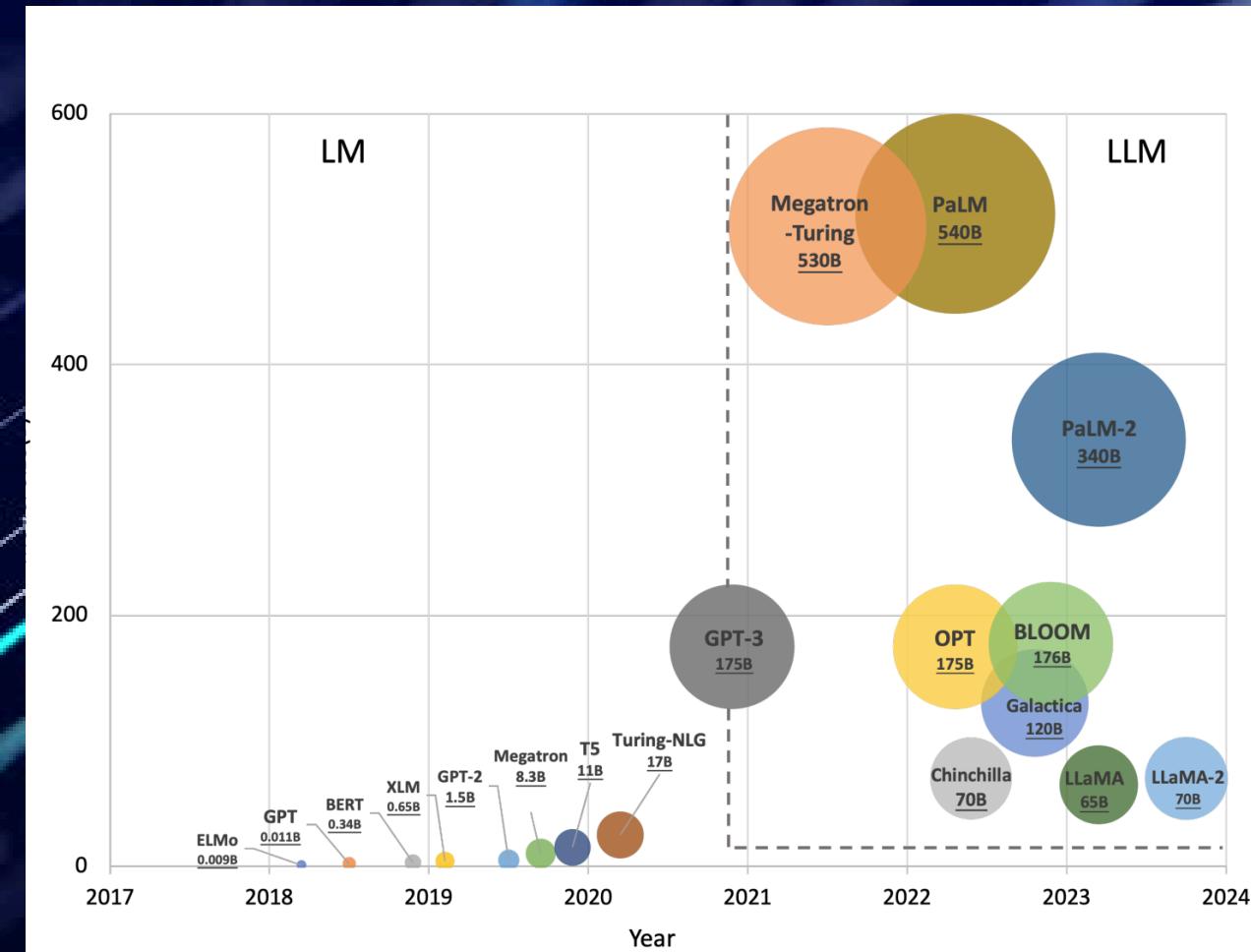
# What makes LLM large?

“

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

LLM

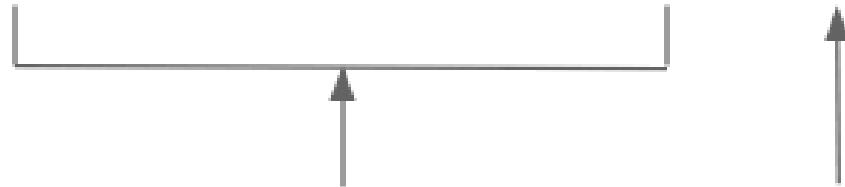
”



# What is a language model?

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

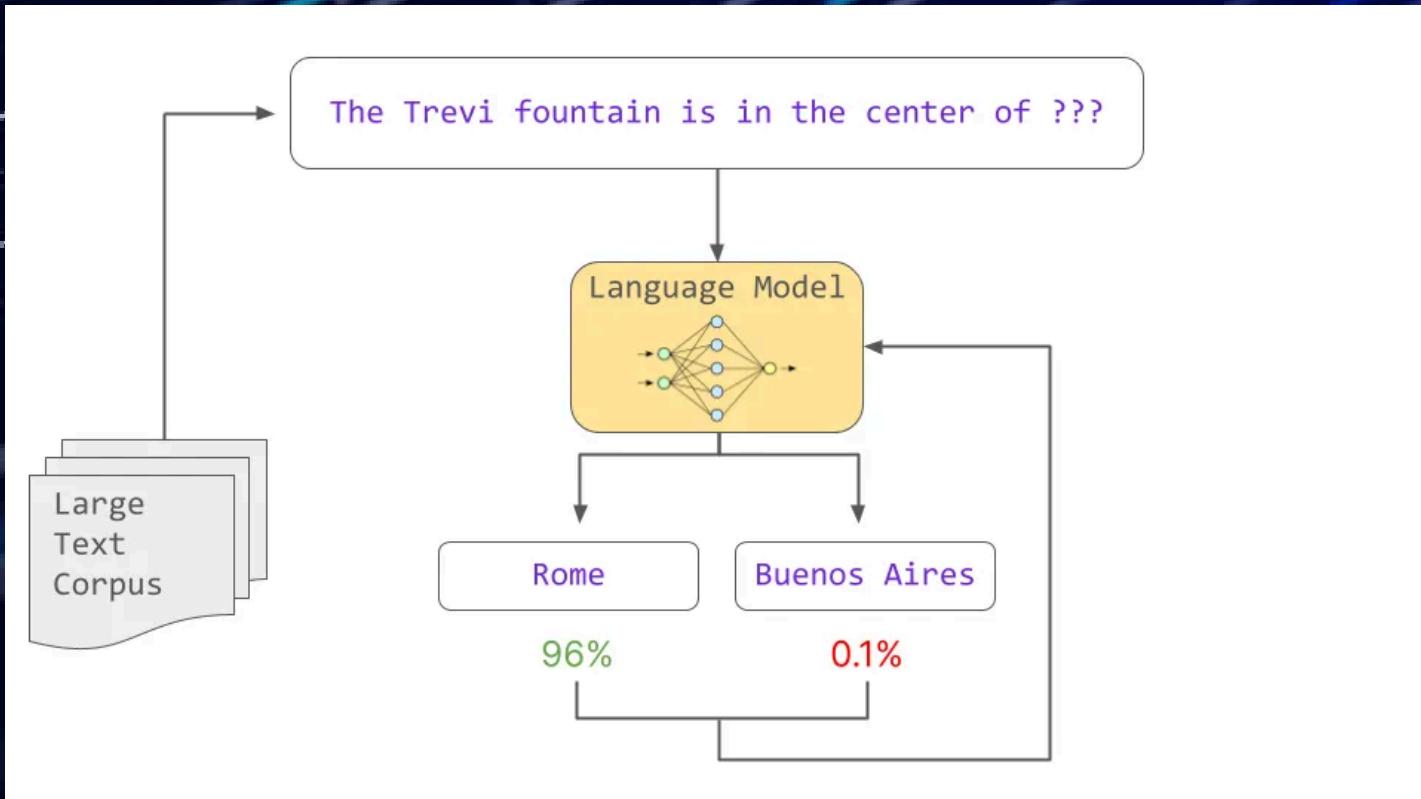
$S = \text{Where are we going}$



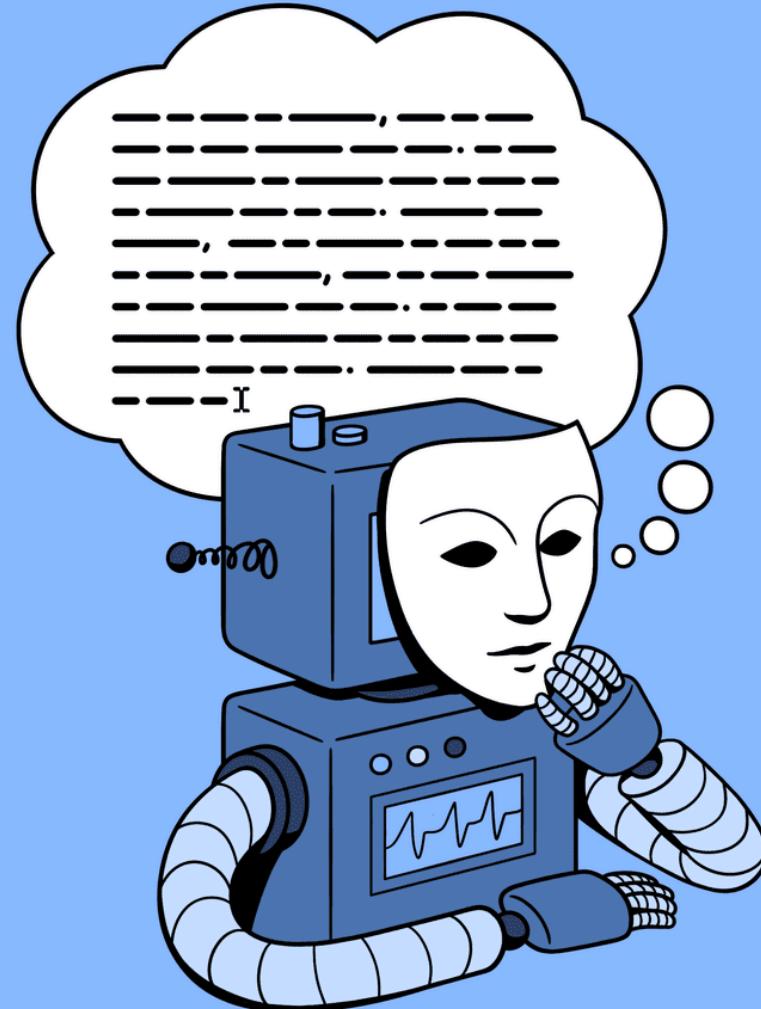
$$P(S) = P(\text{Where}) \times P(\text{are} \mid \text{Where}) \times P(\text{we} \mid \text{Where are}) \times P(\text{going} \mid \text{Where are we})$$

# 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)

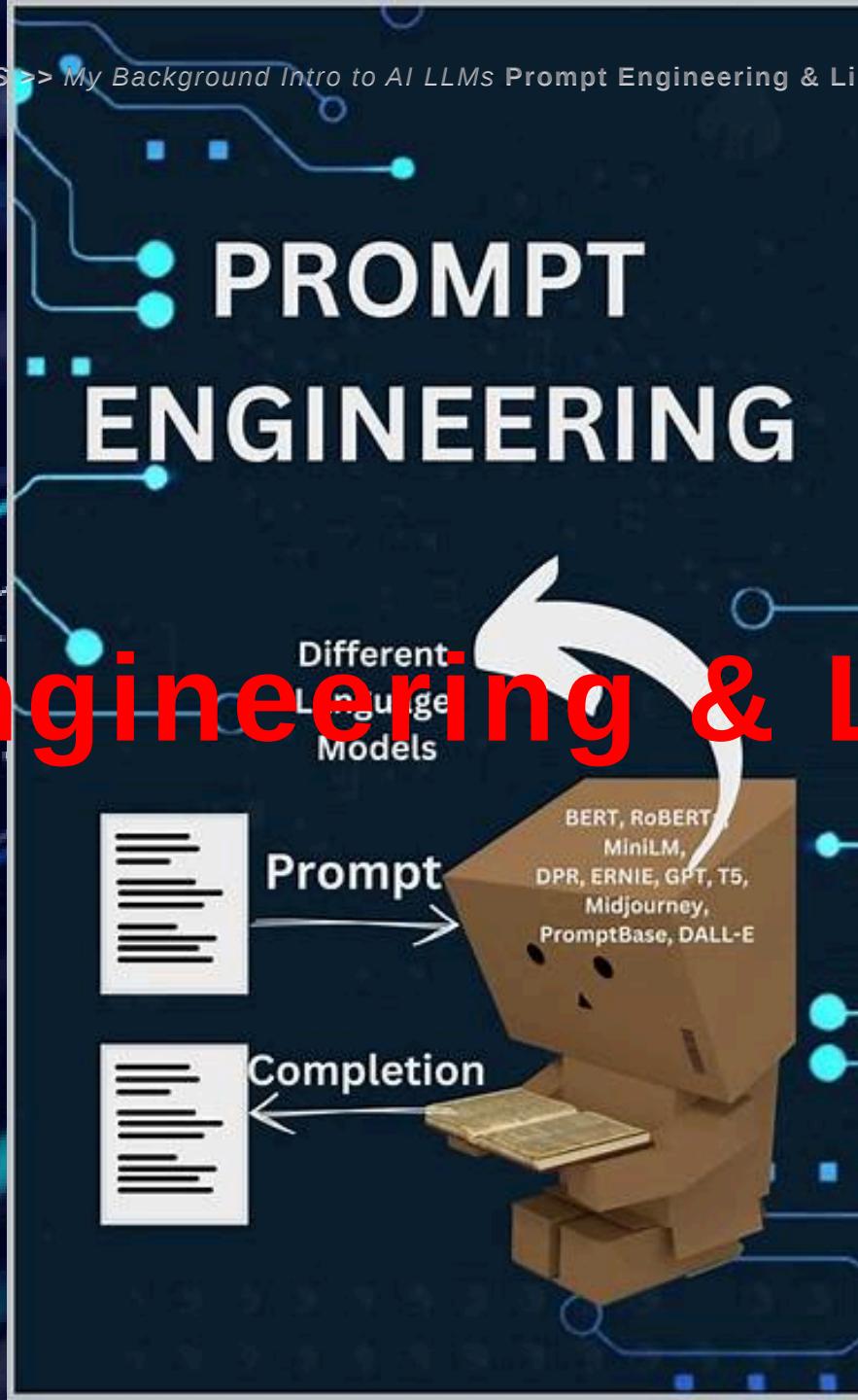
[lärj 'laŋ-gwij 'mä-dəl]

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

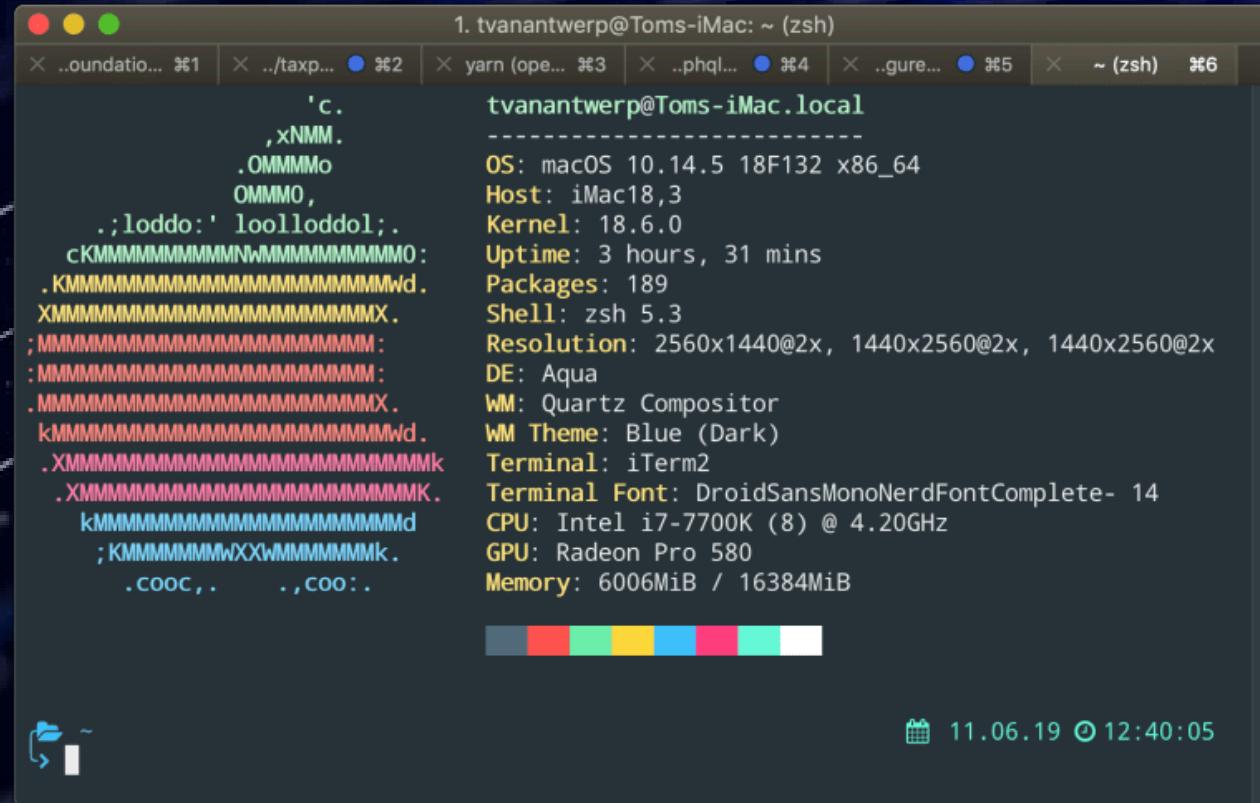
# Top AI chatbos in 2024 powered by LLM

Source

# Prompt Engineering & Linguistics

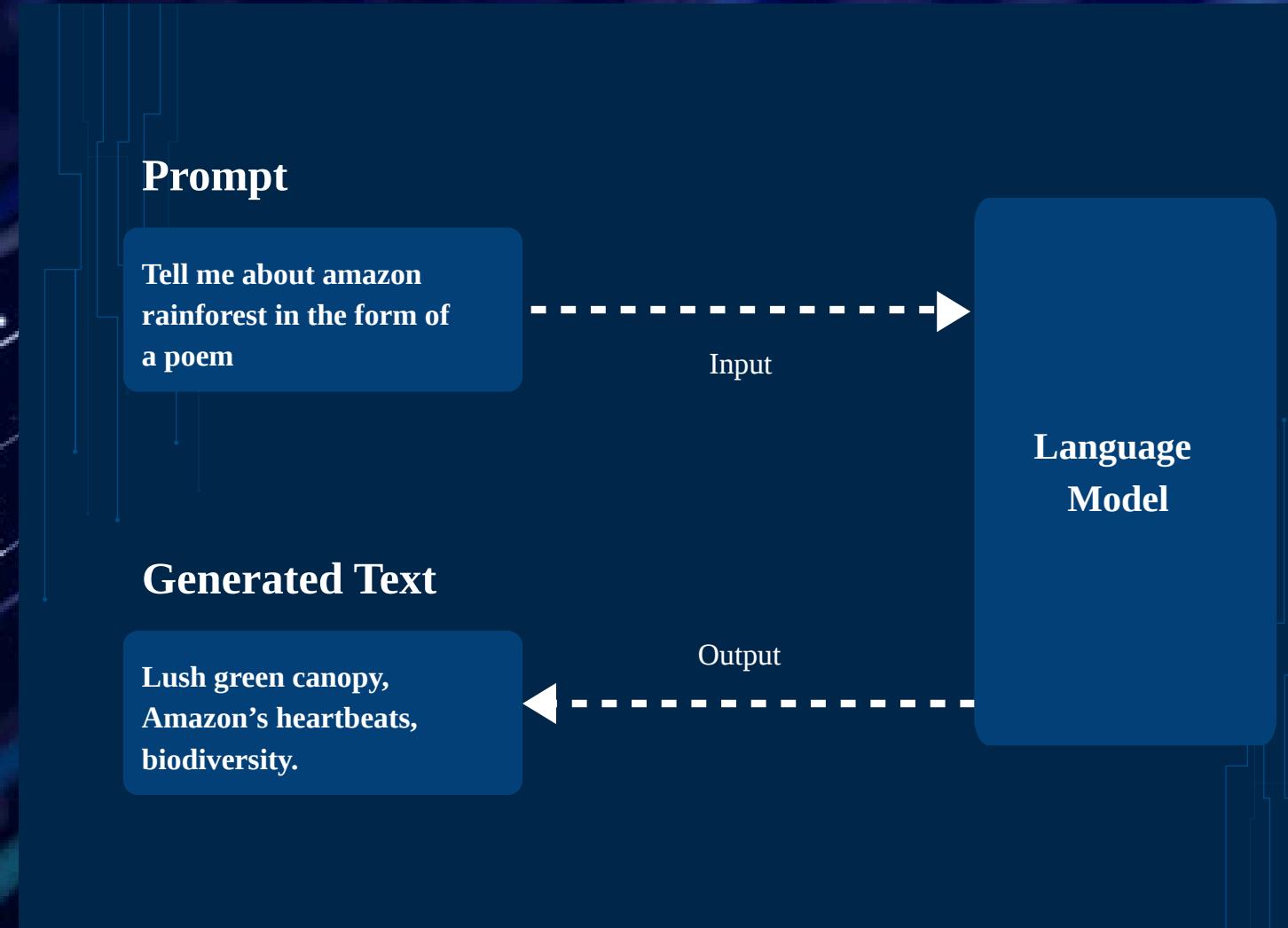


# Prompt on the terminal

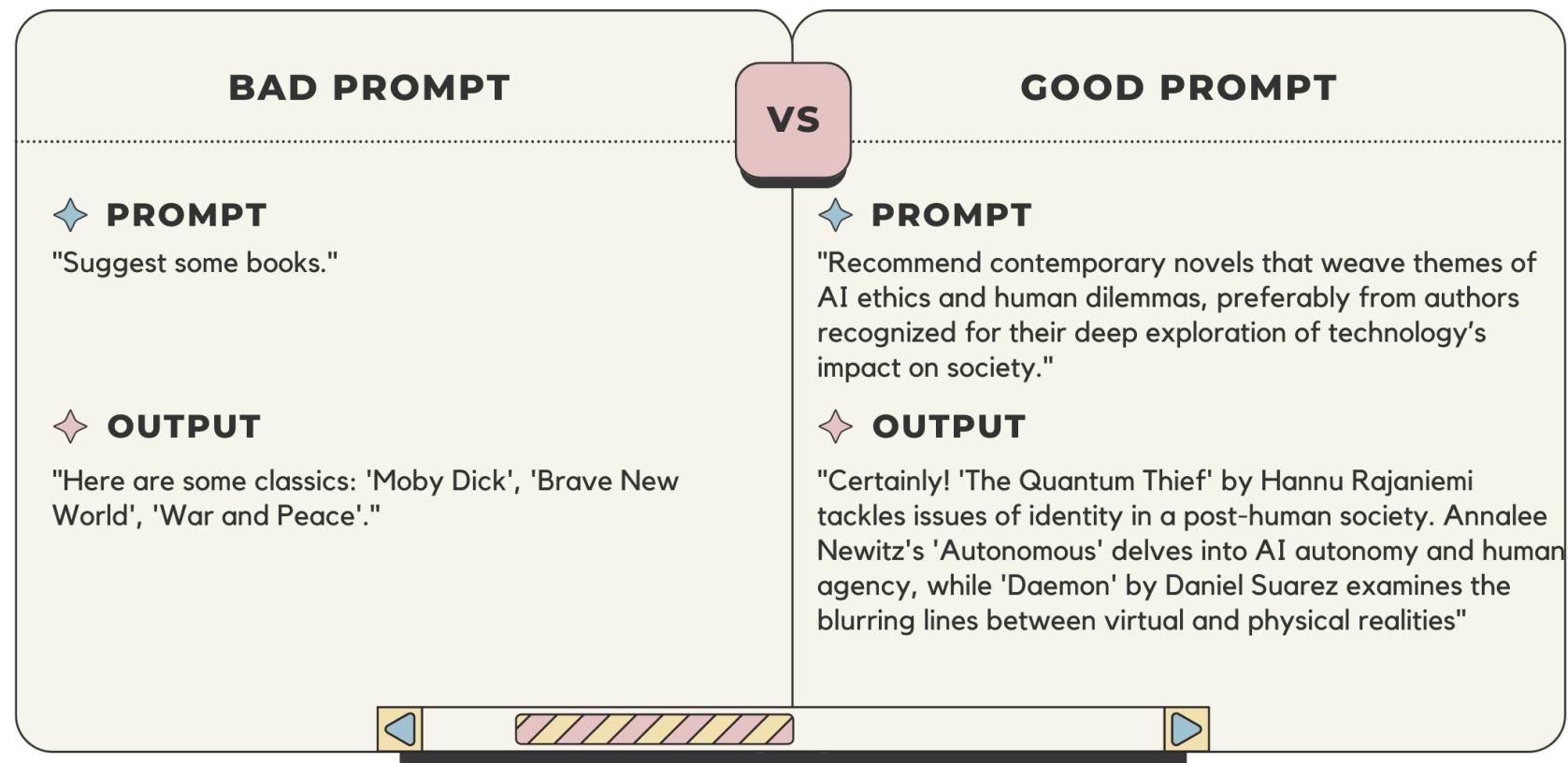


# Prompt in GenAI

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

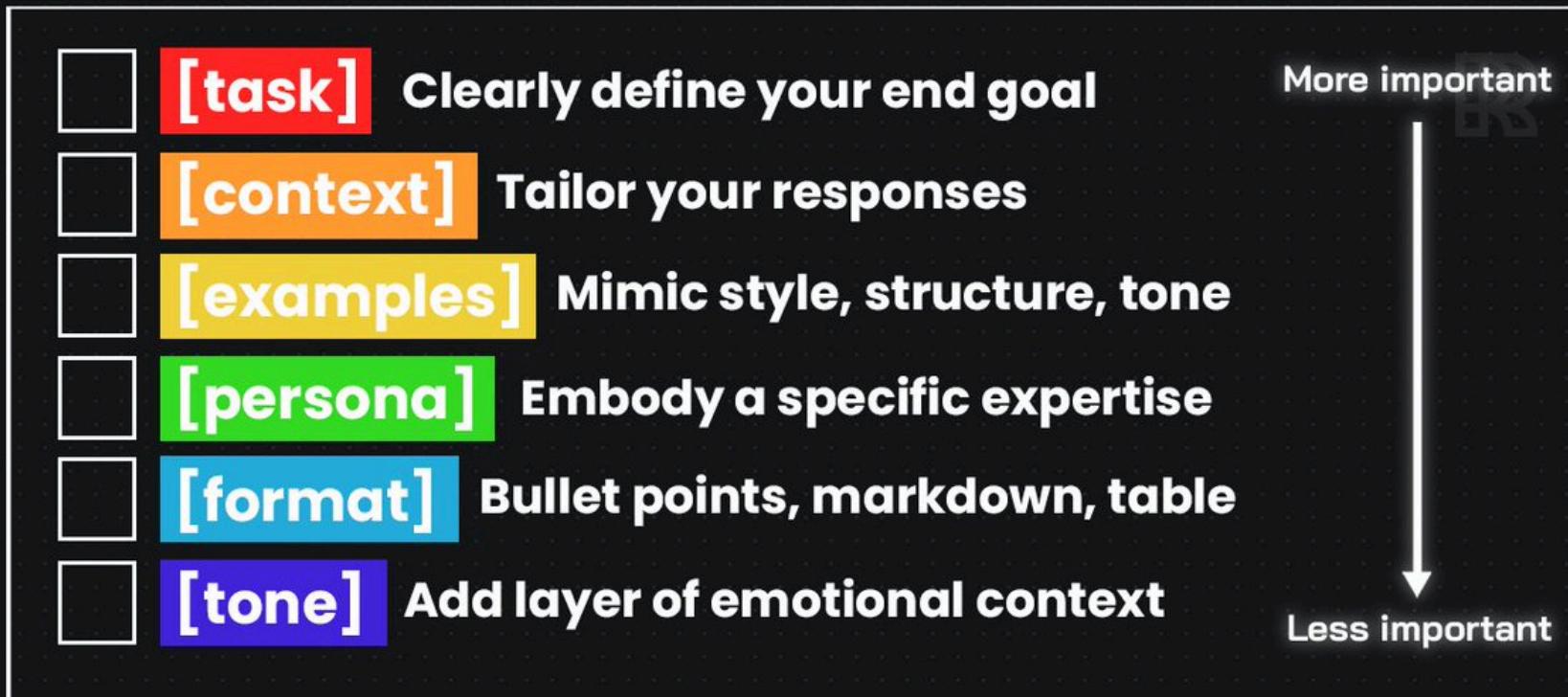


# What makes a good prompt?



# Elements of a good prompt

## The 6-Step Prompt Checklist

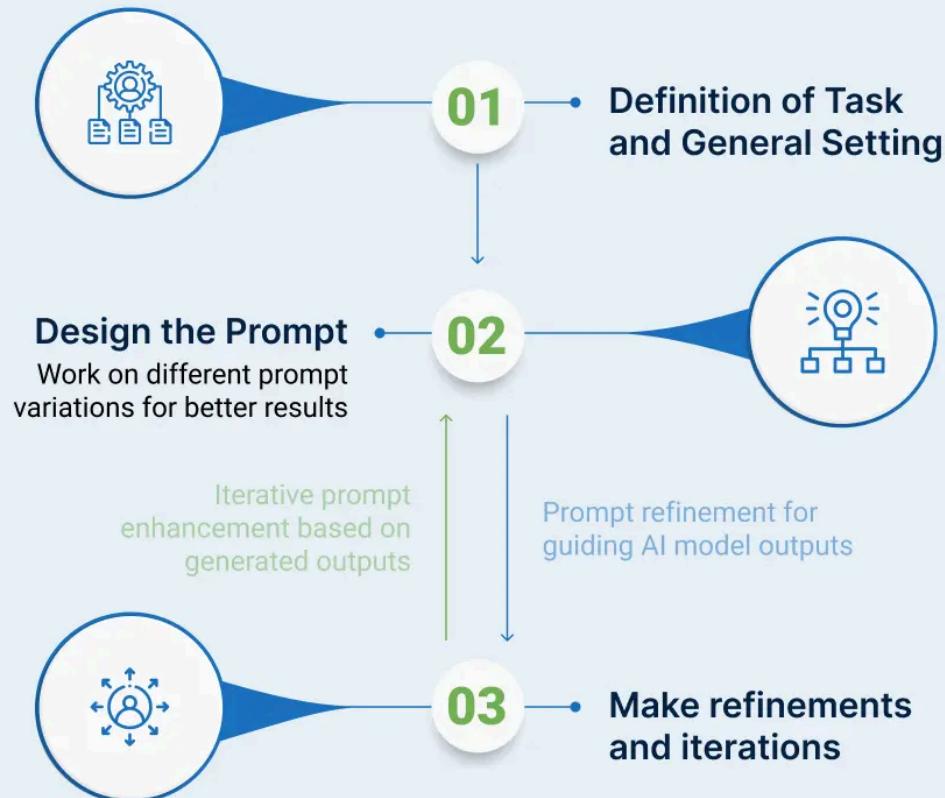


[www.therundown.ai](http://www.therundown.ai)

## 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



# 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

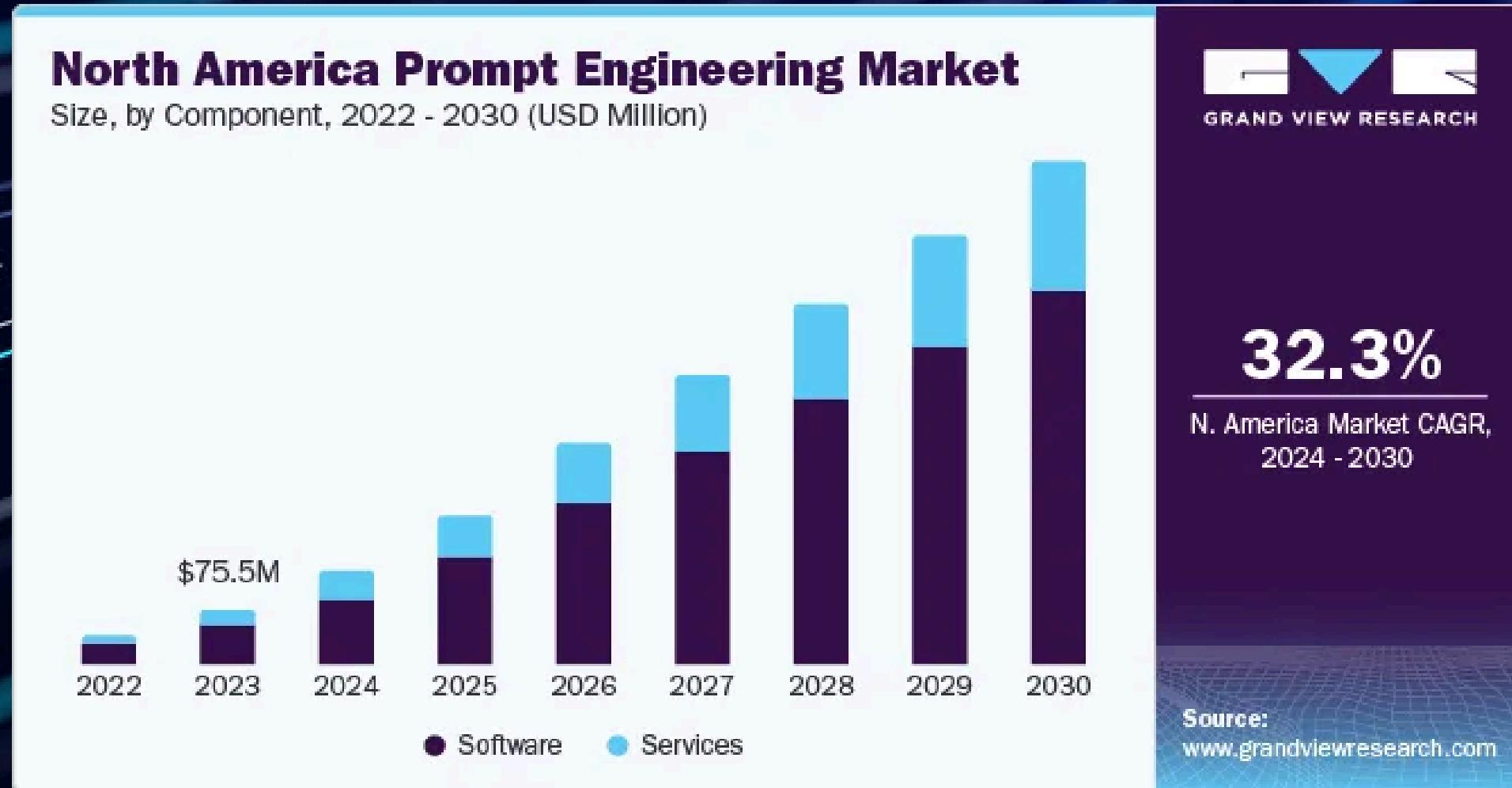
### Skills

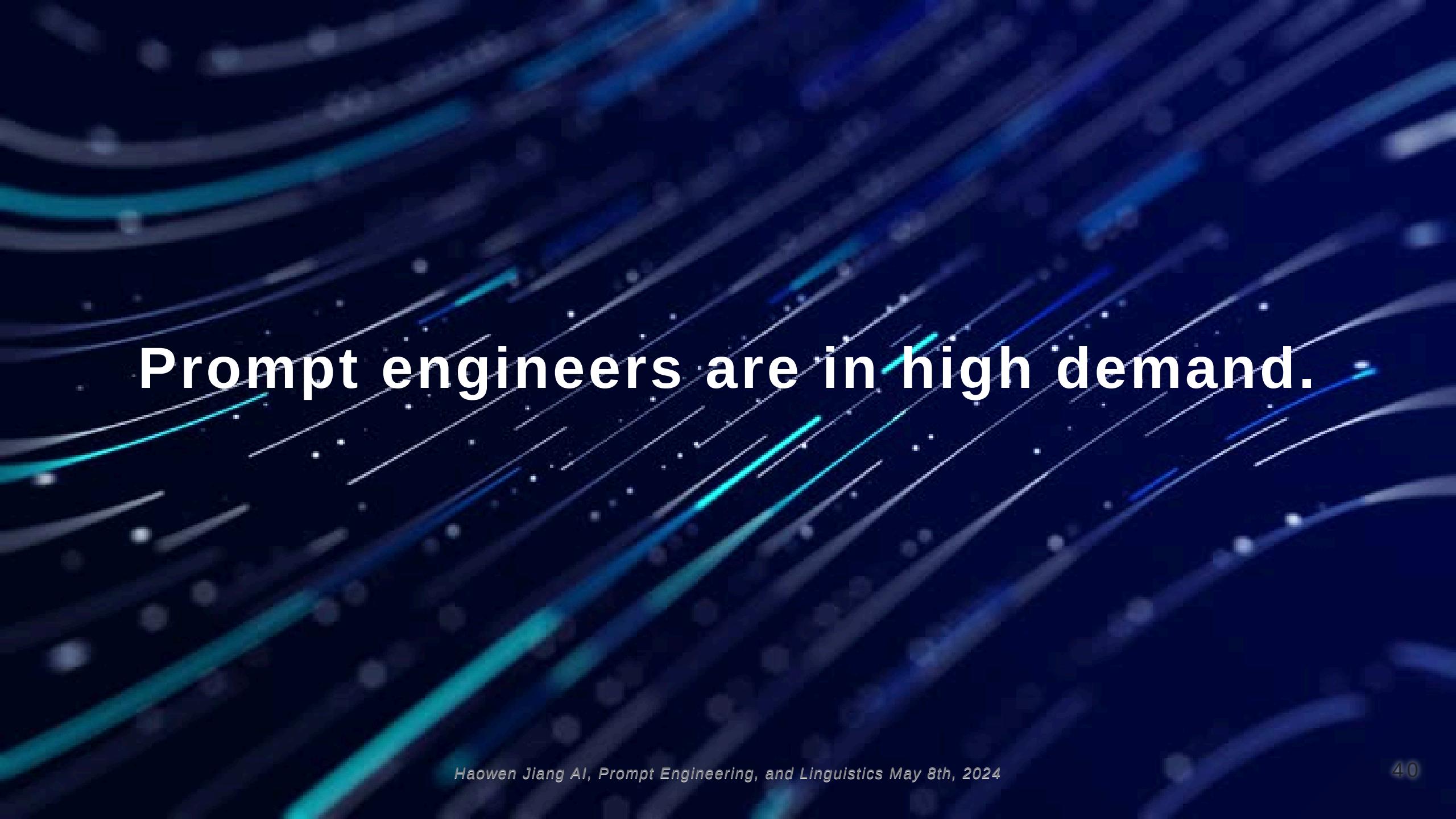
- Excellent knowledge of natural language processing
- Knowledge of machine learning
- Comprehensive knowledge of AI-generated content development

### 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



← 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



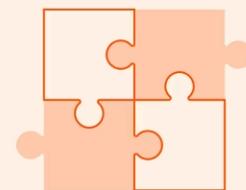
Language



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

**ELEVATE X**  
Unleashing the power of freelancing

## Prompt Engineering

**How to structure Prompts:**

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

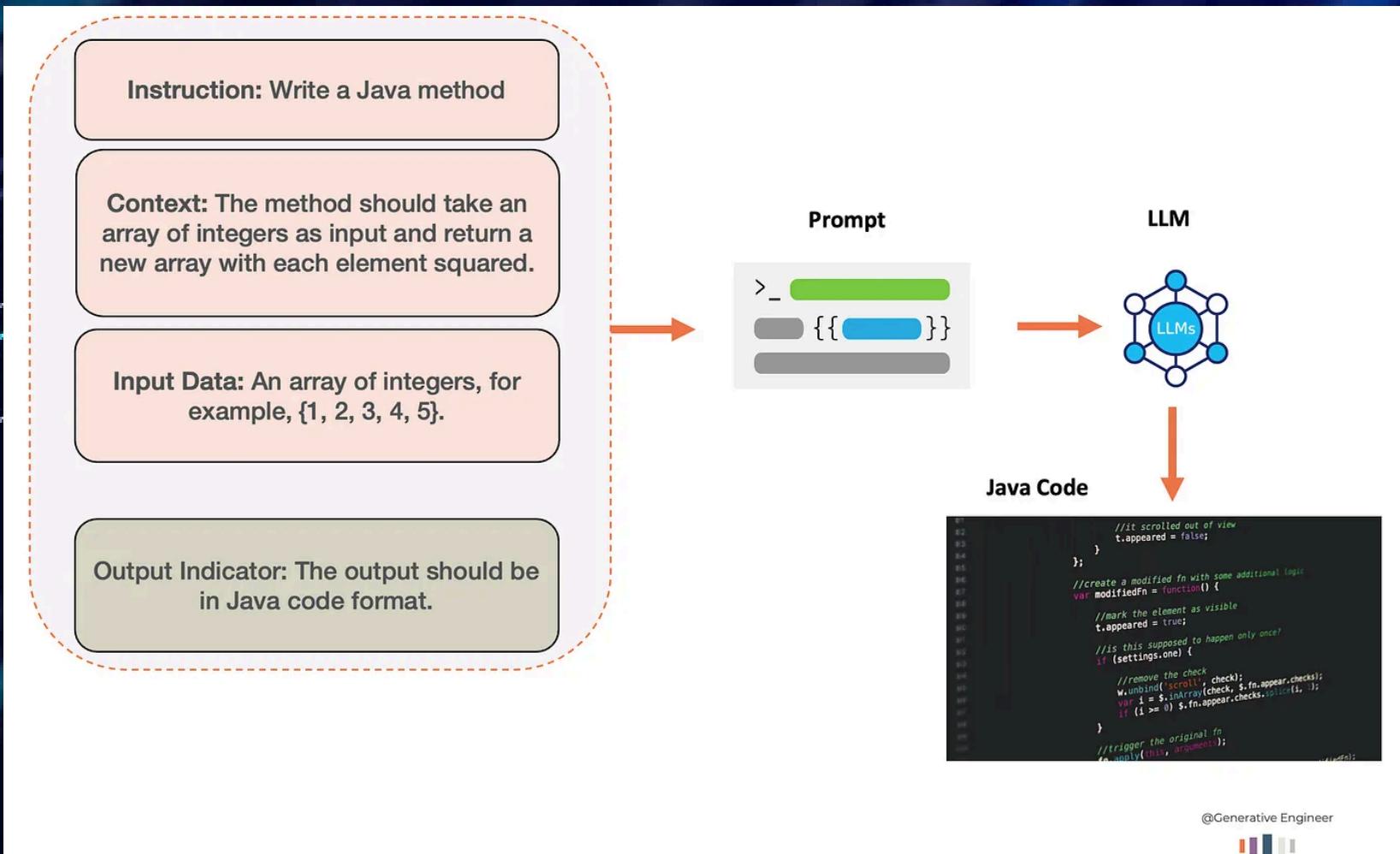
# Prompt engineering skill - critical thinking

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

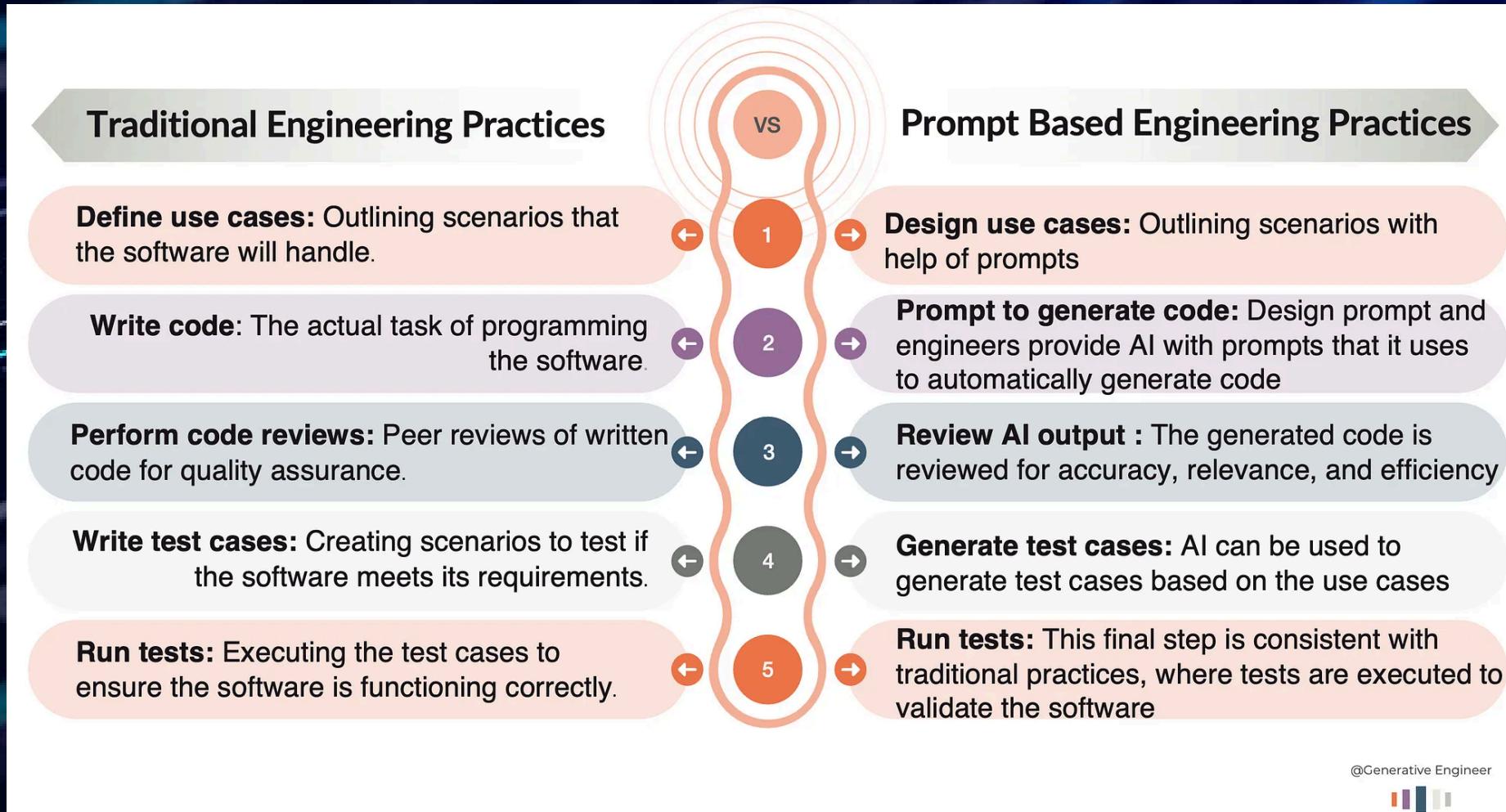
## English is the most powerful programming language — even for data science: Introduction to prompt engineering

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 screenshot shows a user interface for defining extraction patterns. There are three main sections, each with an 'add attribute' button and a red minus sign icon.

- Token 1:** A dropdown menu set to `? LIKE_NUM` with a green checkmark icon. Below it is a purple rounded rectangle containing the text `add attribute`.
- Token 2:** A dropdown menu set to `? POS` with the value `ADJ` displayed. Below it is another dropdown menu set to `? OP` with the value `?`  displayed. Below it is a purple rounded rectangle containing the text `add attribute`.
- Token 3:** A dropdown menu set to `? POS` with the value `NOUN` displayed. Below it is another dropdown menu set to `? OP` with the value `? +`  displayed. Below it is a purple rounded rectangle containing the text `add attribute`.

At the bottom left are two buttons: `add token` and `refresh text`. At the bottom right is a blue rounded rectangle containing the text `refresh text`.

The screenshot shows a text input field with a yellow border. At the top right are three buttons: `Show tokens`, `displaCy`, and `displaCyENT`.

The text input field contains the following message:

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>