

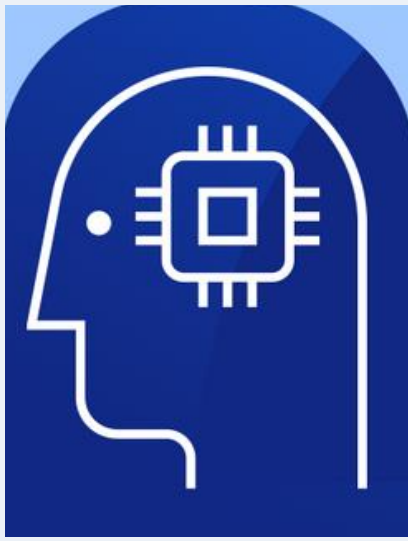


Norwegian  
Business School

# GenAI for Research

Foundation Shubin Yu





# Introduction to Generative AI

# What is Generative AI (GenAI)



A robot is painting (March 2023 vs Jan 2024)



Generative AI refers to artificial intelligence systems that can create new content, such as text, images, audio, or video, based on patterns learned from existing data.

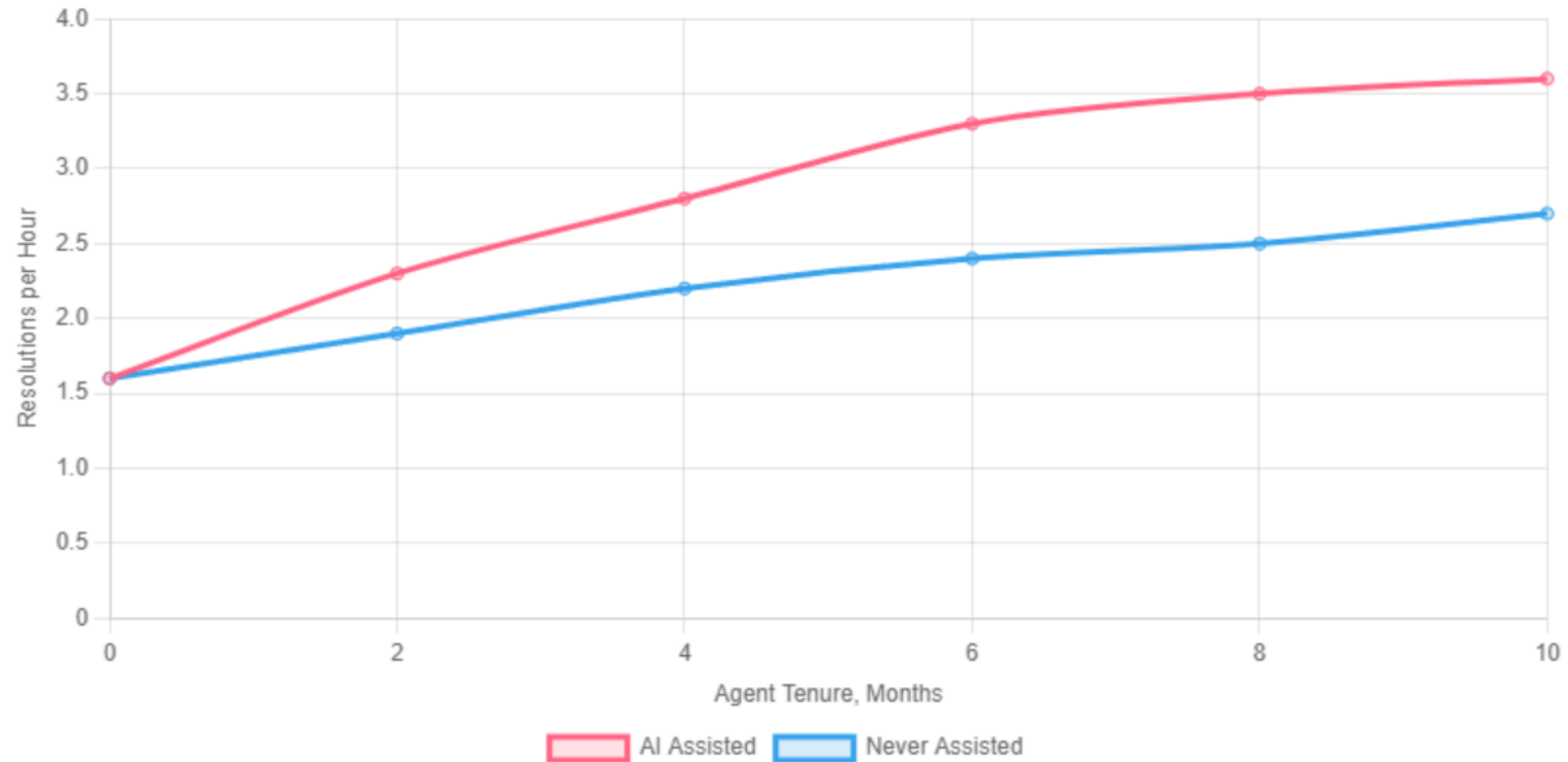
<https://openart.ai/create>

<https://hotpot.ai/art-generator>

# The impact of GenAI

- OpenAI's research estimates that 80% of current work activities can integrate generative AI technologies and capabilities.
- McKinsey's research indicates that generative AI and other technologies have the potential to automate 60% to 70% of the tasks that currently occupy employees' time.
- In a study by Resume Builder involving 1,000 executives (including presidents, CEOs, and chairpersons), 91% of respondents stated that they expect job candidates to be proficient in generative AI. The demand for this skill spans various business fields: 58% of respondents work in software engineering, 33% in customer service, 32% in human resources, 31% in marketing, 28% in data entry, and 23% in sales and finance.

## AI assistance helps newer agents "catch up"





## **Evidence from an increasing number of studies**

### **Coding**

- Software engineers code up to twice as fast using Codex
- Peng et al. (2023)

### **Management**

- Consultants completed tasks 25% more quickly, and their output was 40% higher quality
- Dell'Acqua et al. (2023)

### **Writing**

- Writing tasks completed twice as fast
- Noy and Zhang (2023)

### **Diagnosis**

- Overall reading times shortened when radiologists used AI
- Shin et al. (2023)

- Others: productivity, creativity, job satisfaction

Jensen Huang, CEO Nvidia

“ AI IS NOT GOING TO TAKE YOUR JOB. THE PERSON WHO USES AI WILL. USE AI AS FAST AS YOU CAN, SO THAT YOU CAN STAY GAINFULLY EMPLOYED.

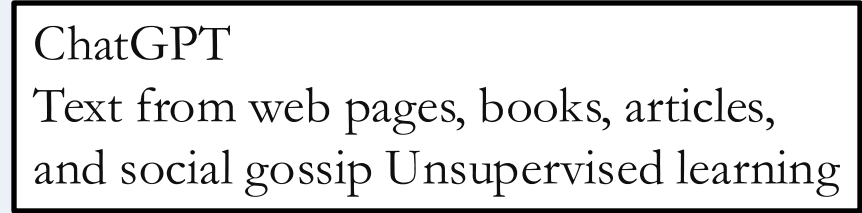
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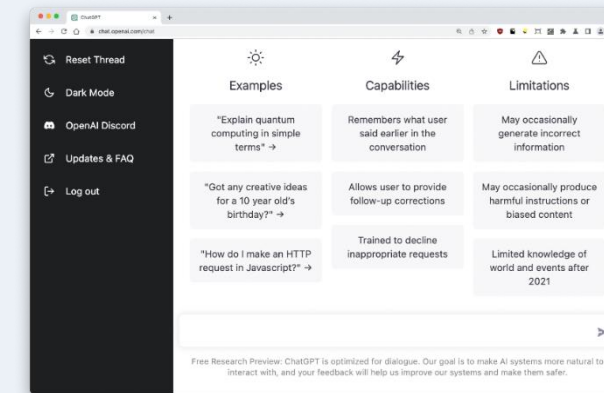
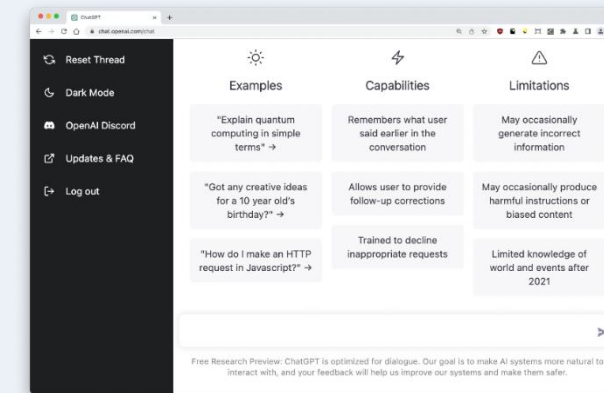
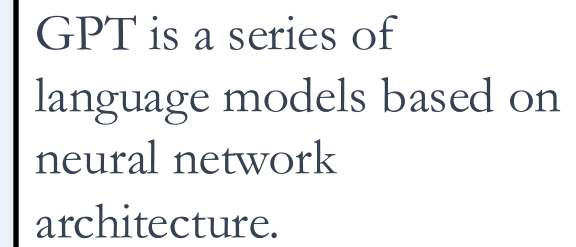
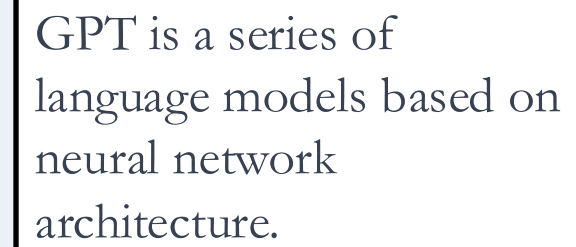


ChatGPT
Text from web pages, books, articles, and social gossip
Unsupervised learning

<p>ChatGPT</p> <p>Text from web pages, books, articles, and social gossip</p> <p>Unsupervised learning</p>
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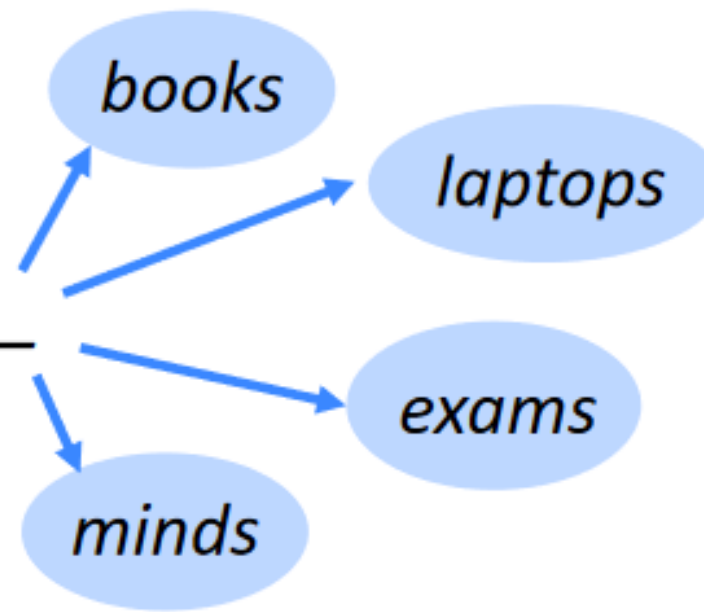


GPT is a series of language models based on neural network architecture.



ChatGPT stands for "Chat Generative Pre-trained Transformer". It is an AI language model developed by OpenAI. The main purpose of ChatGPT is to generate human-like text responses in a conversational manner.

*the students opened their* \_\_\_\_\_



- 
- What about images and sounds? How do multimodal LLMs work?



# Models and techniques

Generative Adversarial Networks (GANs)

Diffusion models

Transformer

Variational Autoencoders (VAEs)

Retrieval-Augmented Generation (RAG)

Recurrent Neural Networks (RNNs)

Autoregressive Models

Convolutional neural networks (CNNs)

Memory Neural Networks (MNNs)

...



# The history of Generative AI

# The history of GenAI

1960s: ELIZA chatbot

1980-1990s: Development of neural networks

2000s: Rise of deep learning

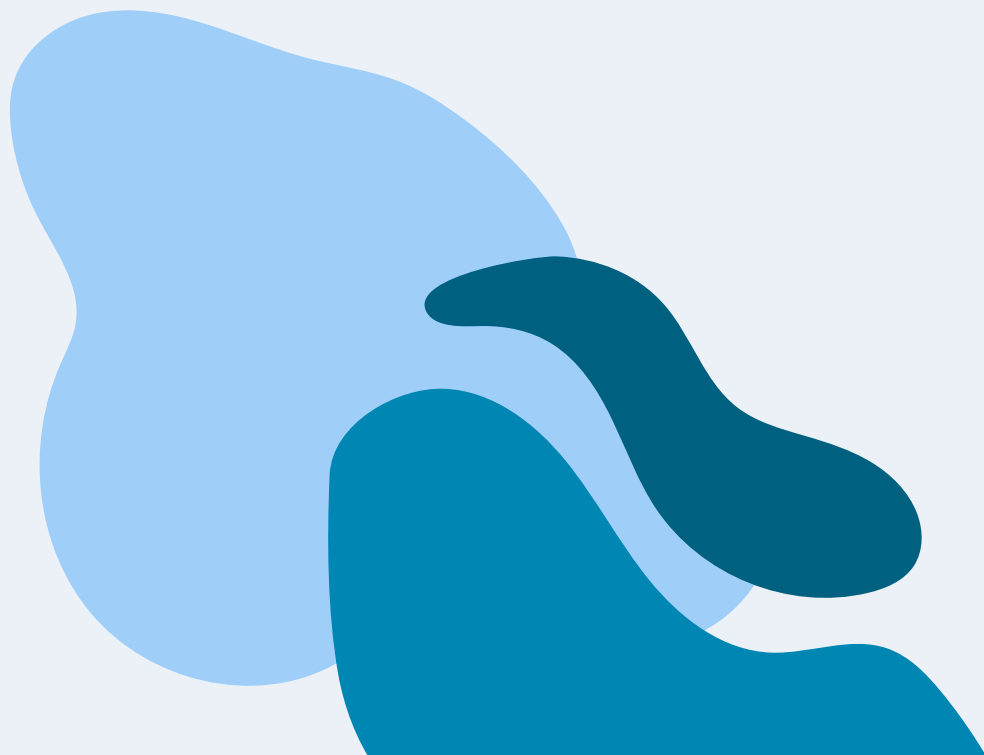
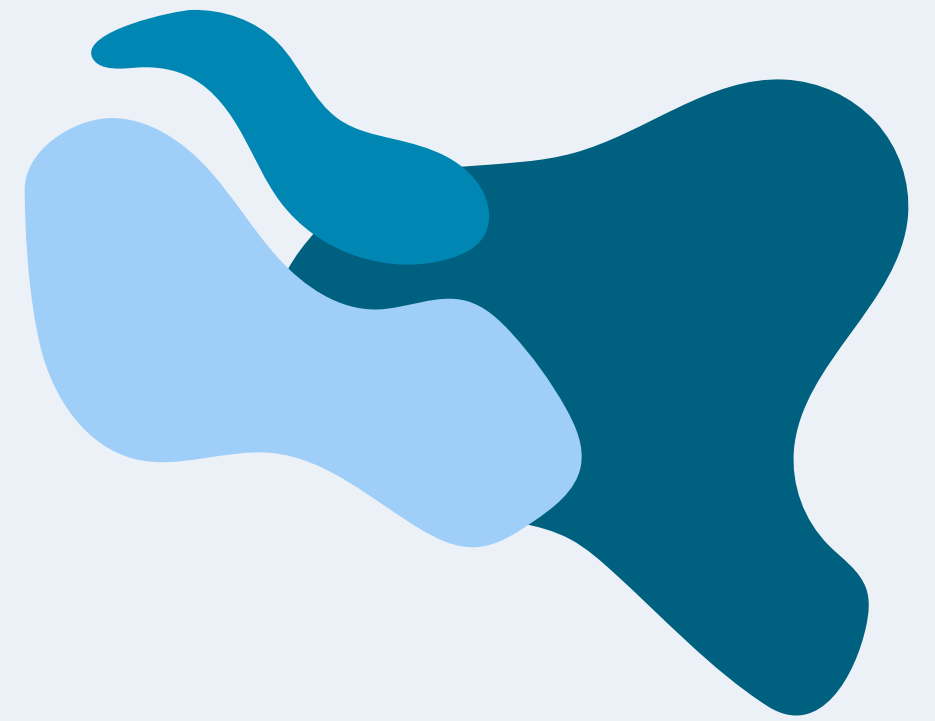
2014: Introduction of Generative Adversarial Networks (GANs)

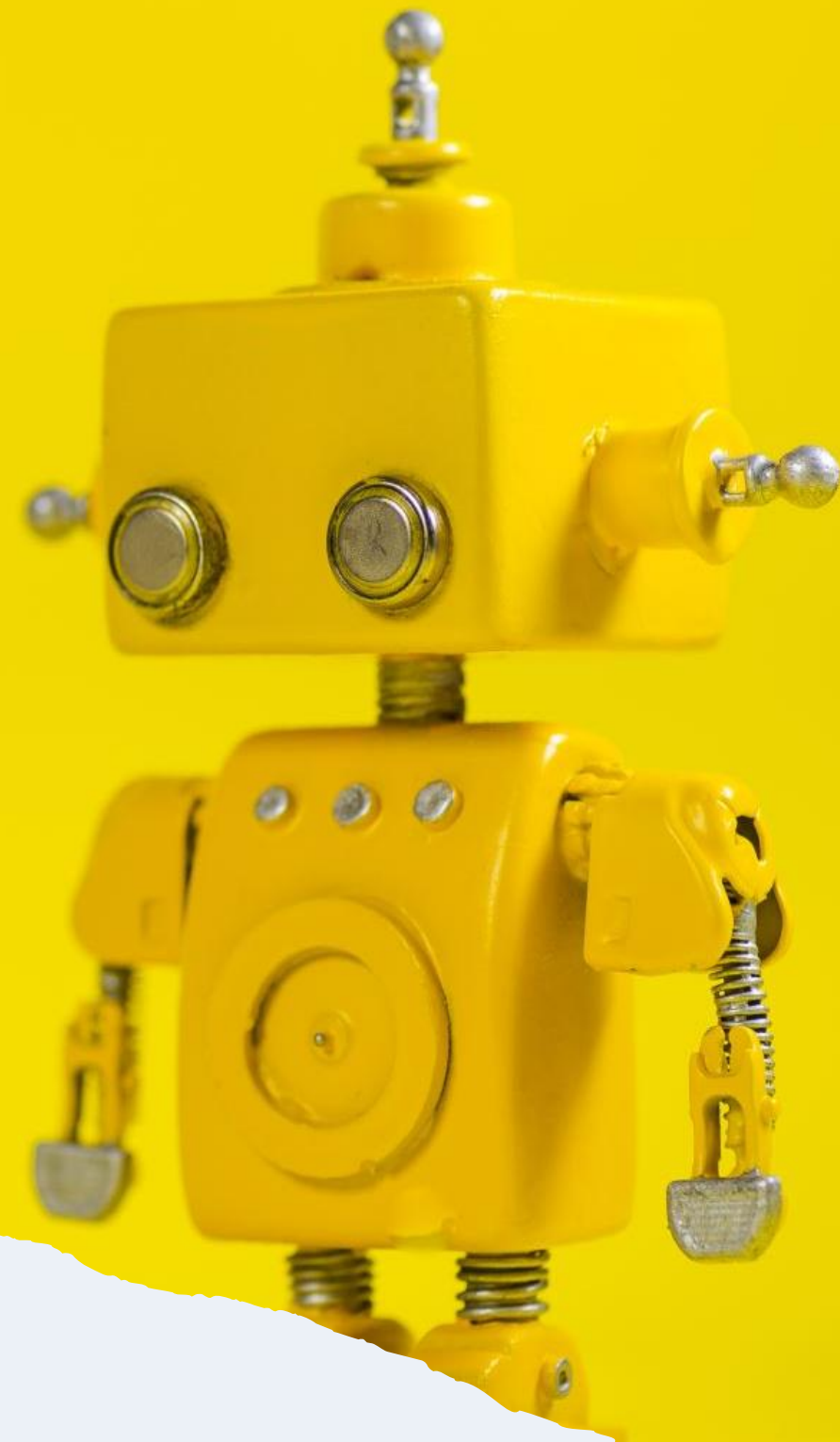
2015: Emergence of Diffusion models

2020: Release of GPT-3

2022: Release of GPT-3.5

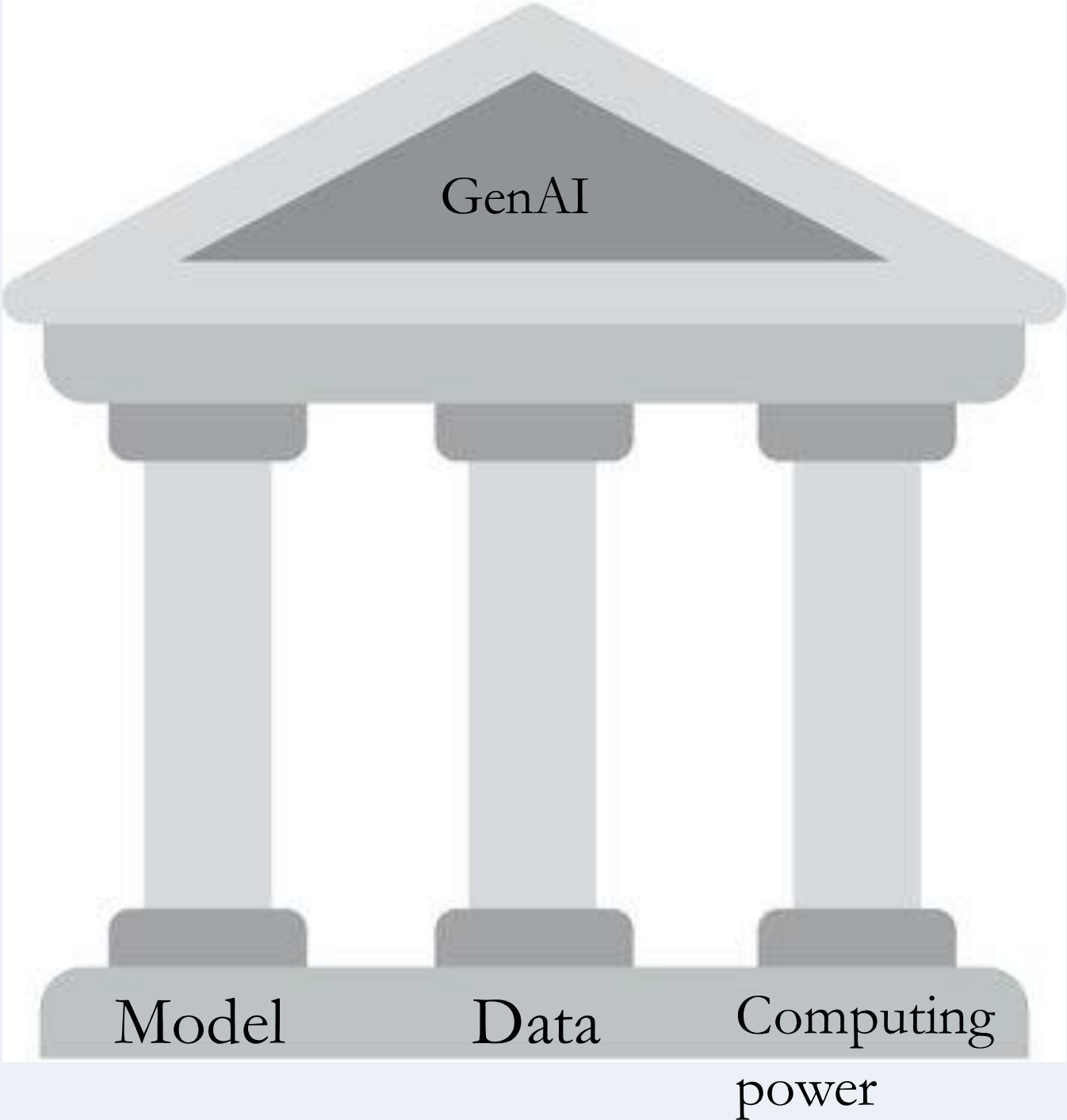
2023: Explosion of various GenAI models





Why is generative AI only emerging now ?

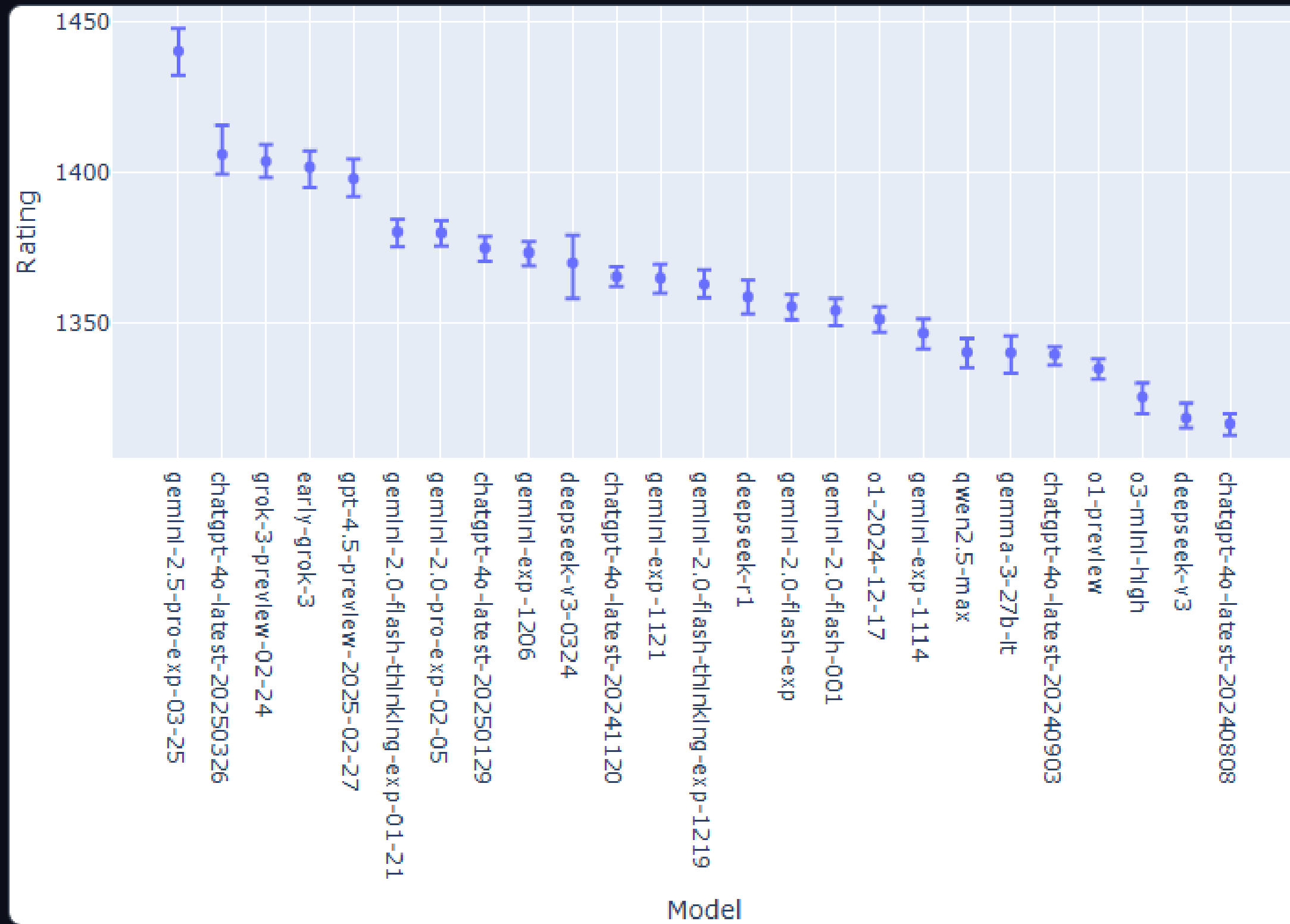


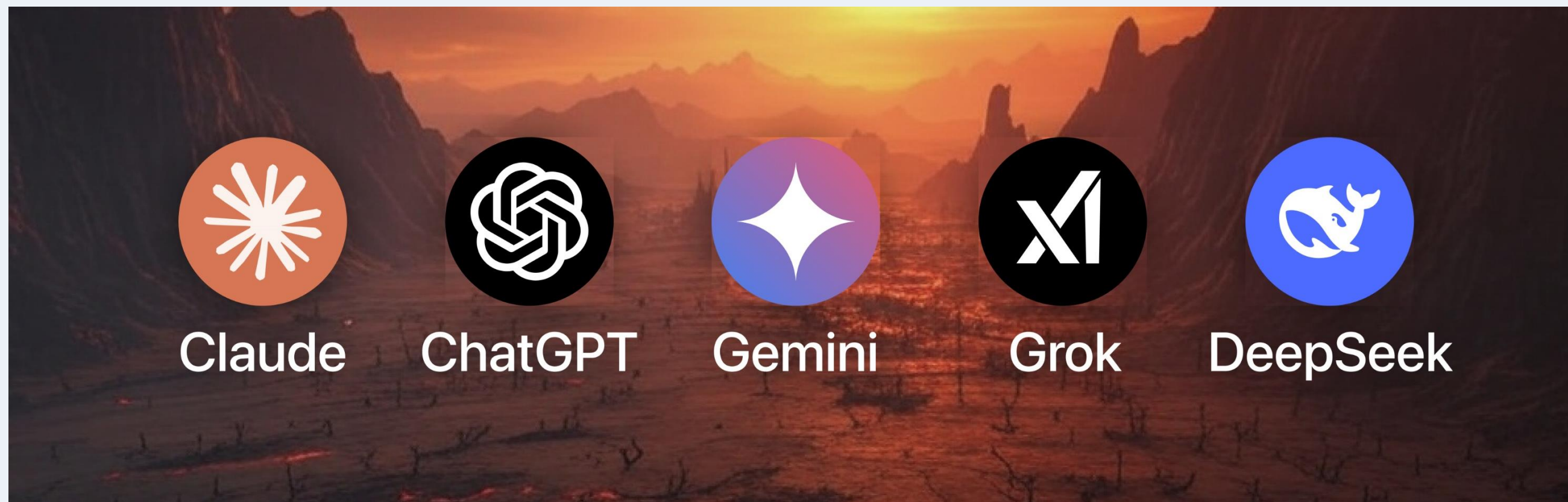




# The Current Development of GenAI

Figure 1: Confidence Intervals on Model Strength (via Bootstrapping)





Claude

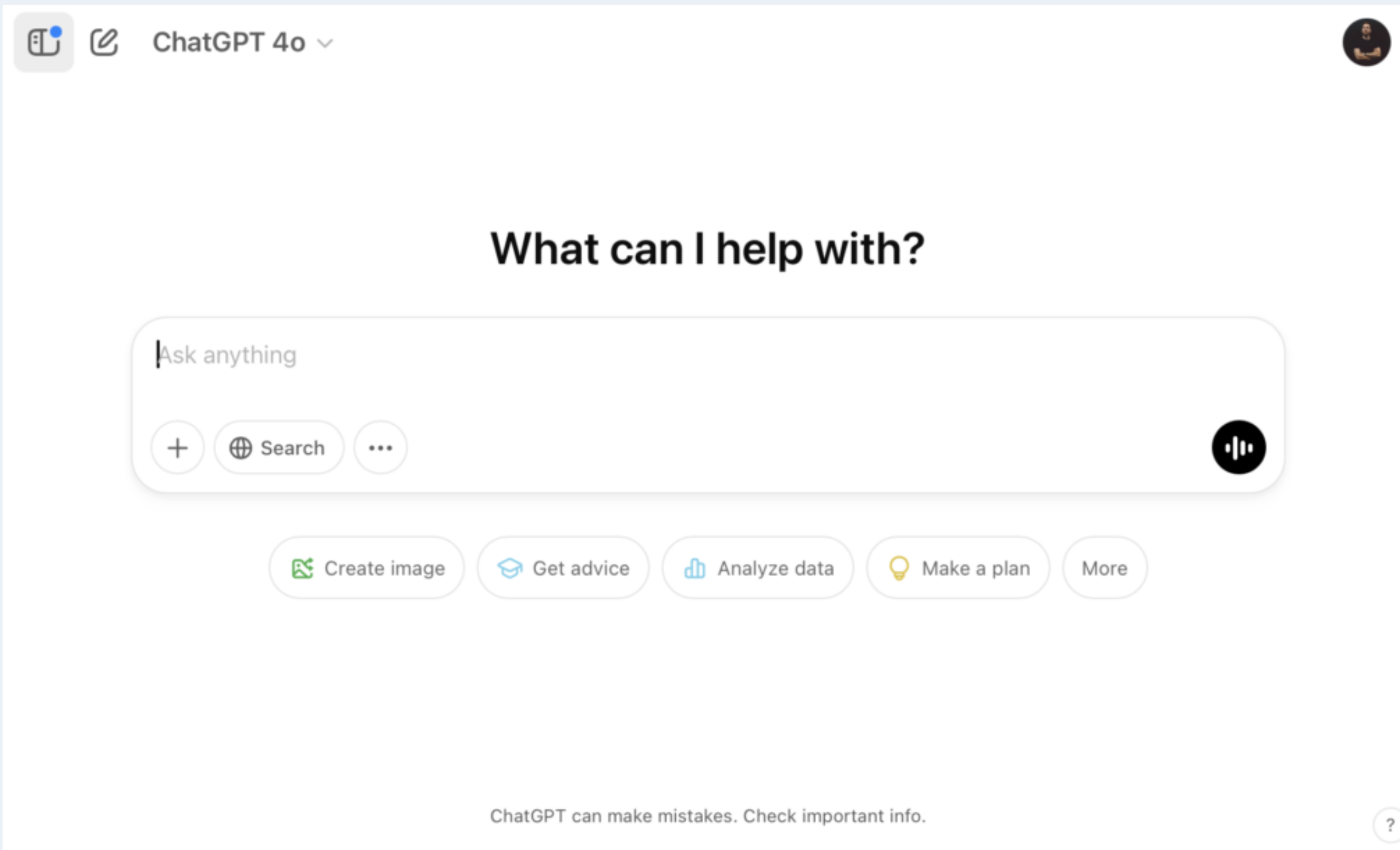
ChatGPT

Gemini

Grok

DeepSeek

# OpenAI GPT



GPT 4.5

GPT 4.1

GPT o3

Search

Deep Search

Live mode

Canva

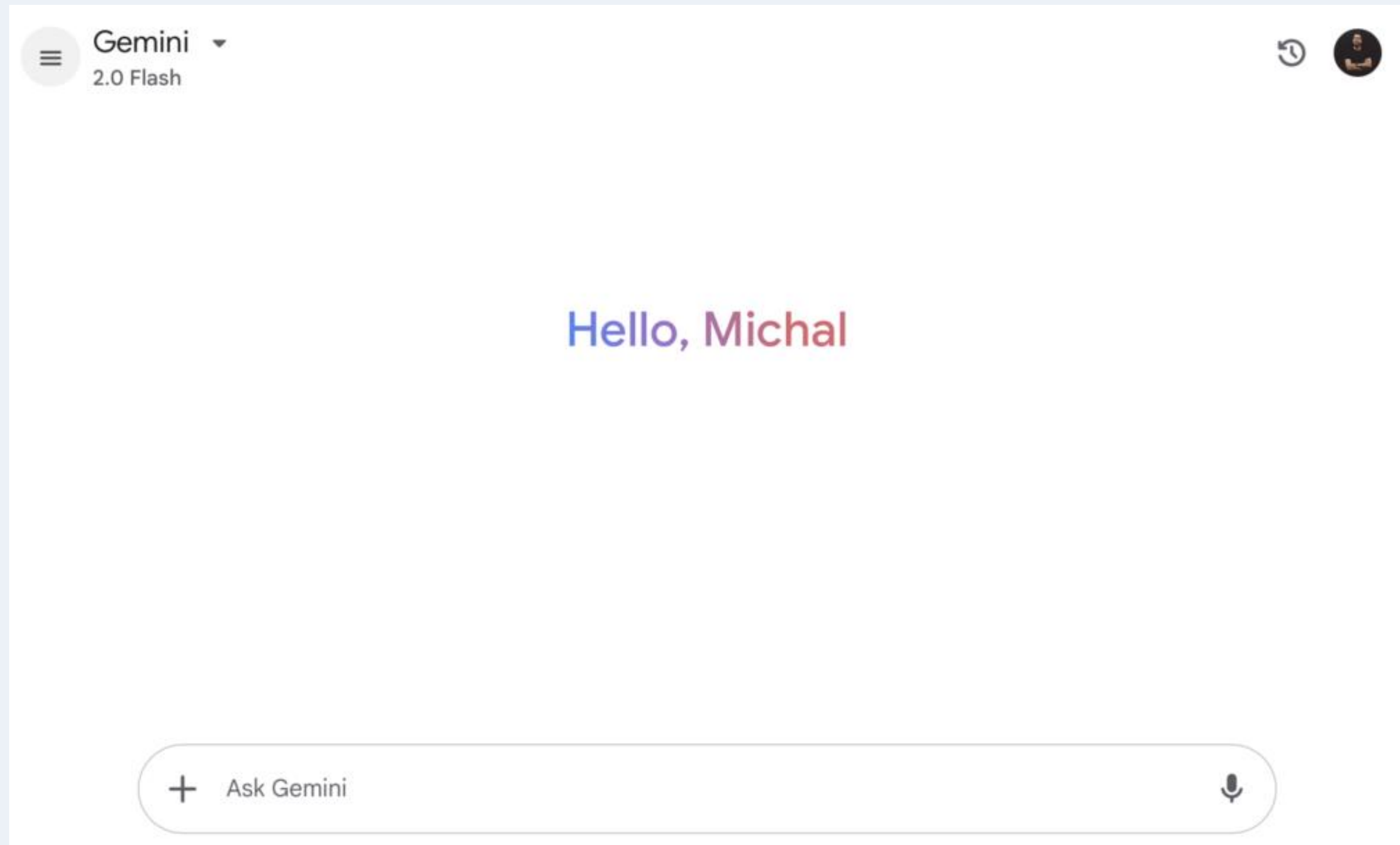
Operator

Customized GPT



# Gemini

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Gemini 2.5 Pro

Efficient (low cost and fast)

Notebook LM

Co-scientist

Learn about

# Deepseek

deepseek



New chat

No chat history

Get App **NEW**

My Profile



Hi, I'm DeepSeek.

How can I help you today?

Message DeepSeek

DeepThink (R1)

Search



AI-generated, for reference only

R1  
v3

Open source  
Low cost




Generative AI for Research Initiative  
GAIforResearch.com



# Claude

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 Good afternoon, Lance

How can Claude help you today?

Claude 3.7 Sonnet ▾  Choose style ▾

Collaborate with Claude using documents, images, and more




Provide stakeholder  
perspective

Extract insights from  
report

Polish your prose



 NEW

## Analysis tool

Upload CSVs for Claude to analyze quantitative data with high accuracy and create interactive data visualizations. [Try it out](#)

Sonnet 3.7

Programming

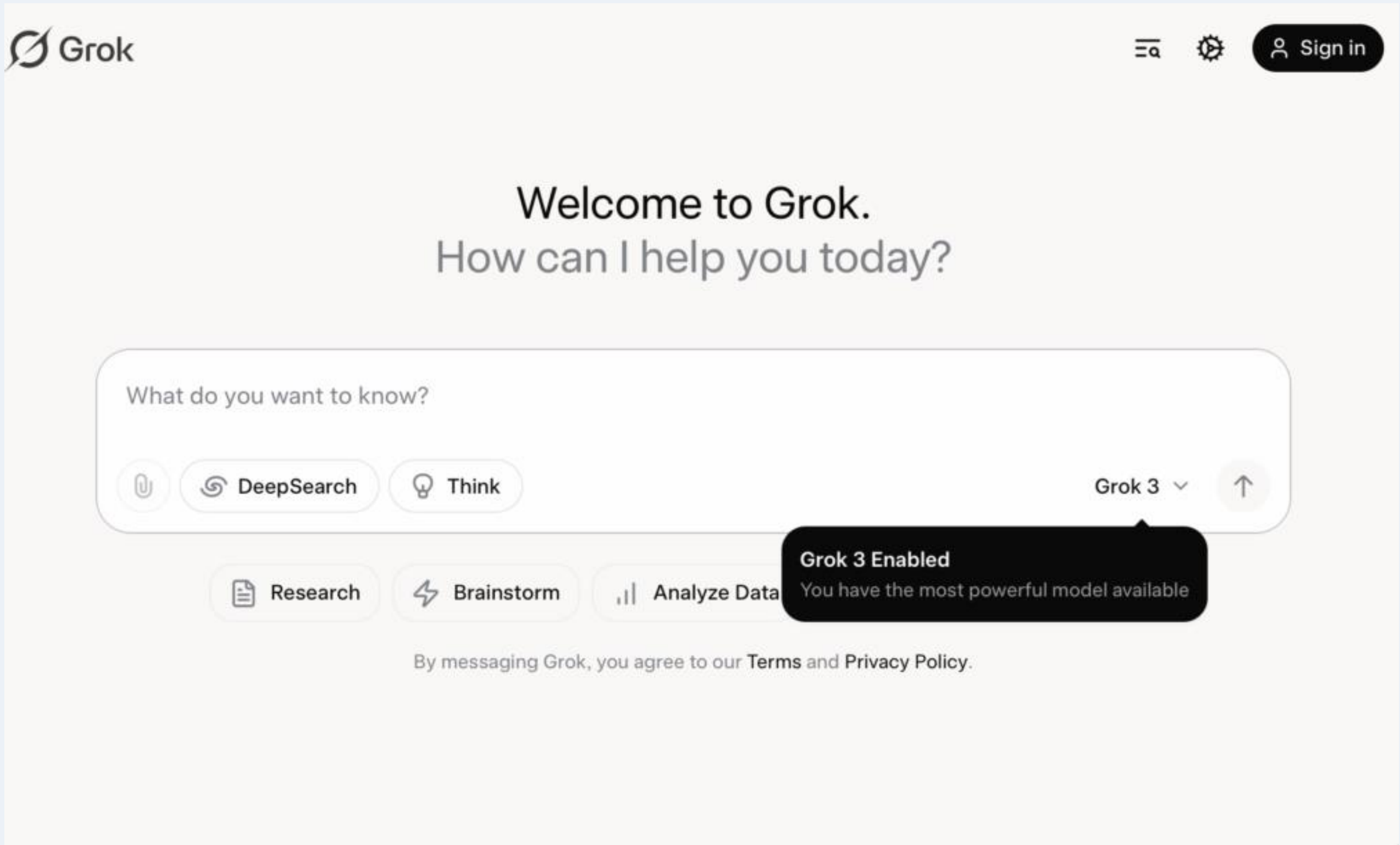
Writing

Low cost

App preview



# Grok 3



# Generative AI Applications

## **Text Generation:**

- Utilizes large language models to generate contextually relevant text
- Can be used for tasks such as dialogue, explanation, summarization, etc.

## **Image Generation:**

- Uses techniques like GANs and VAEs to generate high-quality, realistic images
- Applied in fields such as art, design, entertainment, etc.

## **Audio Generation:**

- Creates music, text-to-speech, synthesized voices
- Applied in media, entertainment, education, and other fields

# Generative AI Applications

## **Video Generation:**

- Creates dynamic videos based on text descriptions or images
- Applied in fields such as art, entertainment, education, healthcare, etc.

## **Code Generation:**

- Generates code snippets, functions, or complete programs
- Assists in software development, debugging, and testing

## **Data Generation and Augmentation:**

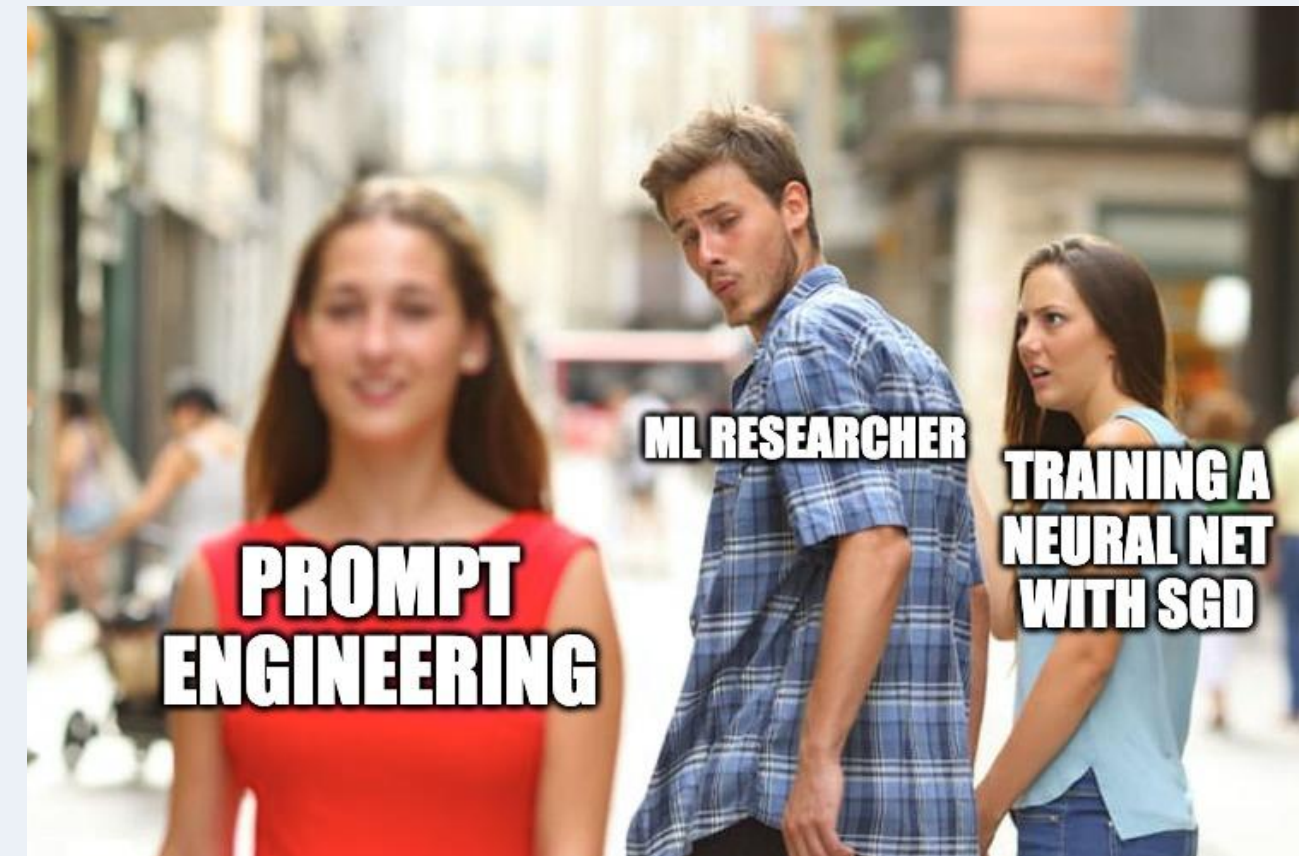
- Generates synthetic data, enhances existing datasets
- Applied in healthcare, gaming, education, autonomous driving, and other fields

## **Virtual World Creation:**

- Creates realistic virtual environments and virtual characters
- Applied in gaming, entertainment, education, metaverse platforms, etc.

# Human-GenAI communication

- Prompt engineering is the practice of designing inputs for generative AI tools that will produce optimal outputs (Mckinsey, 2024)
- Say something that AI can easily understand and follow!



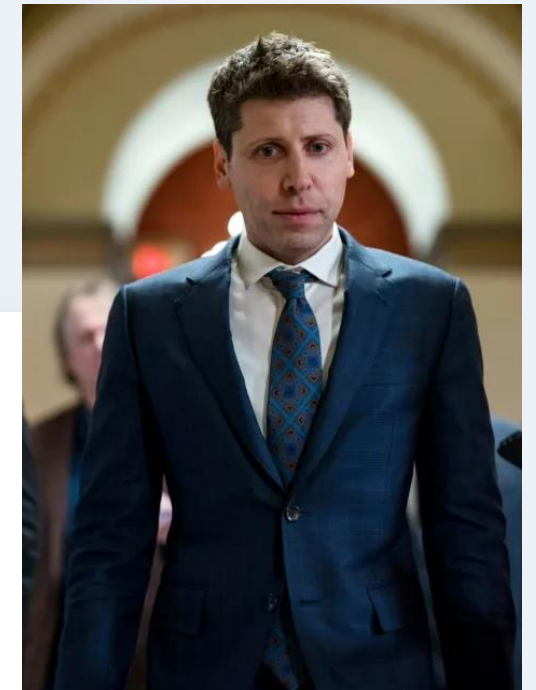


Technique	Description
Zero-shot Prompting	Directly asking questions without providing examples, relying on the AI's pre-trained knowledge.
Few-shot Prompting	Providing a few examples before the main question to guide the AI's response format and style.
Chain of Thought (CoT)	Encouraging AI to show step-by-step reasoning for problem-solving, improving transparency and accuracy.
Tree of Thought (ToT)	Exploring multiple reasoning paths, similar to a decision tree, for more comprehensive solutions.
Self-consistency	Generating multiple independent solutions and choosing the most common or reasonable answer.
Prompt Templates	Using standardized prompt structures with placeholders for specific content, ensuring consistency.
Role-playing Prompts	Asking AI to assume specific roles or personas to provide specialized perspectives.
Step-by-step Prompting	Breaking complex tasks into a series of simple steps, guiding AI through each stage.
Reverse Prompting	Asking AI to generate prompts that would lead to a specific output, exploring AI's associative logic.
AI Interview Technique	Simulating an interview process where AI asks a series of questions to gather detailed information.
Thought Provocation	Using open-ended questions or hypothetical scenarios to stimulate creative thinking.
Meta-prompting	Using prompts to generate or improve other prompts, optimizing AI interaction strategies.

Sam Altman 24, Sep, 2024

“ AI SUPERINTELLIGENCE COULD BE JUST ‘A  
FEW THOUSAND DAYS’ AWAY

”







How can GenAI help  
my research?

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# Use cases in academic research

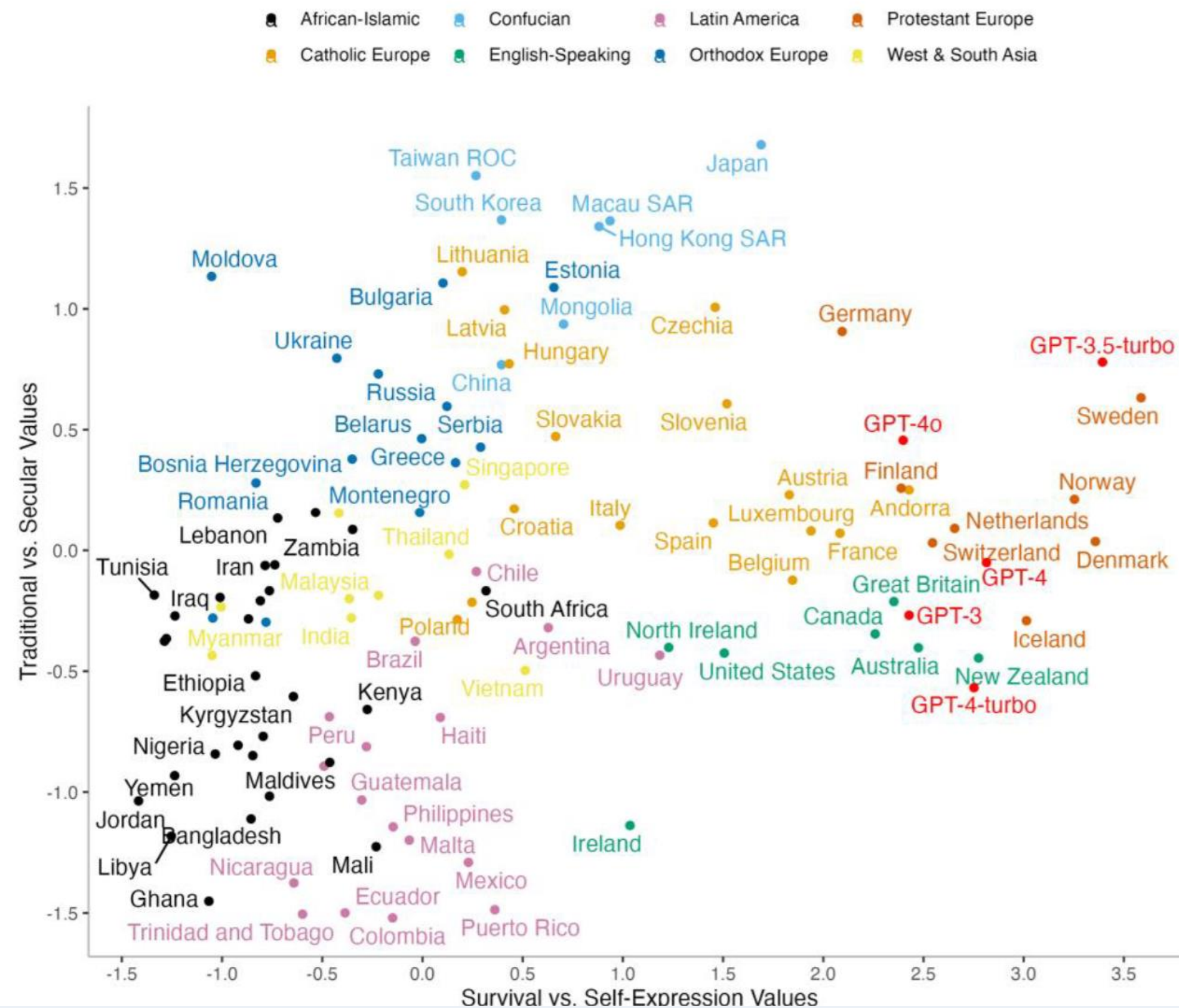
- Created an app to reply to students' email
- Convert a word document into a latex to fit a journal submission guideline
- Use browser use to collect email address of target researchers
- Use deep research to find reviewers relevant to my works
- Created a customized assistant to search relevant scales
- Using LLMs to annotate text data
- Create synthetic data
- Generate realistic experimental materials
- ...

# Discussions



What can be problematic with LLMs?

# Prejudice and bias



Yan Tao, Olga Viberg, Ryan S Baker, René F Kizilcec, Cultural bias and cultural alignment of large language models, PNAS Nexus, Volume 3, Issue 9, September 2024, pgae346, <https://doi.org/10.1093/pnasnexus/pgae346>



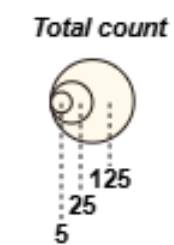
# Gullibility (machine heuristics)

when you need advice but aren't sure who to trust



# Other issues

1. No accountability
2. Plagiarism, ownership
3. Over-dependence
4. Produce negative self-perception: Dehumanization, unethical behavior, impaired memory





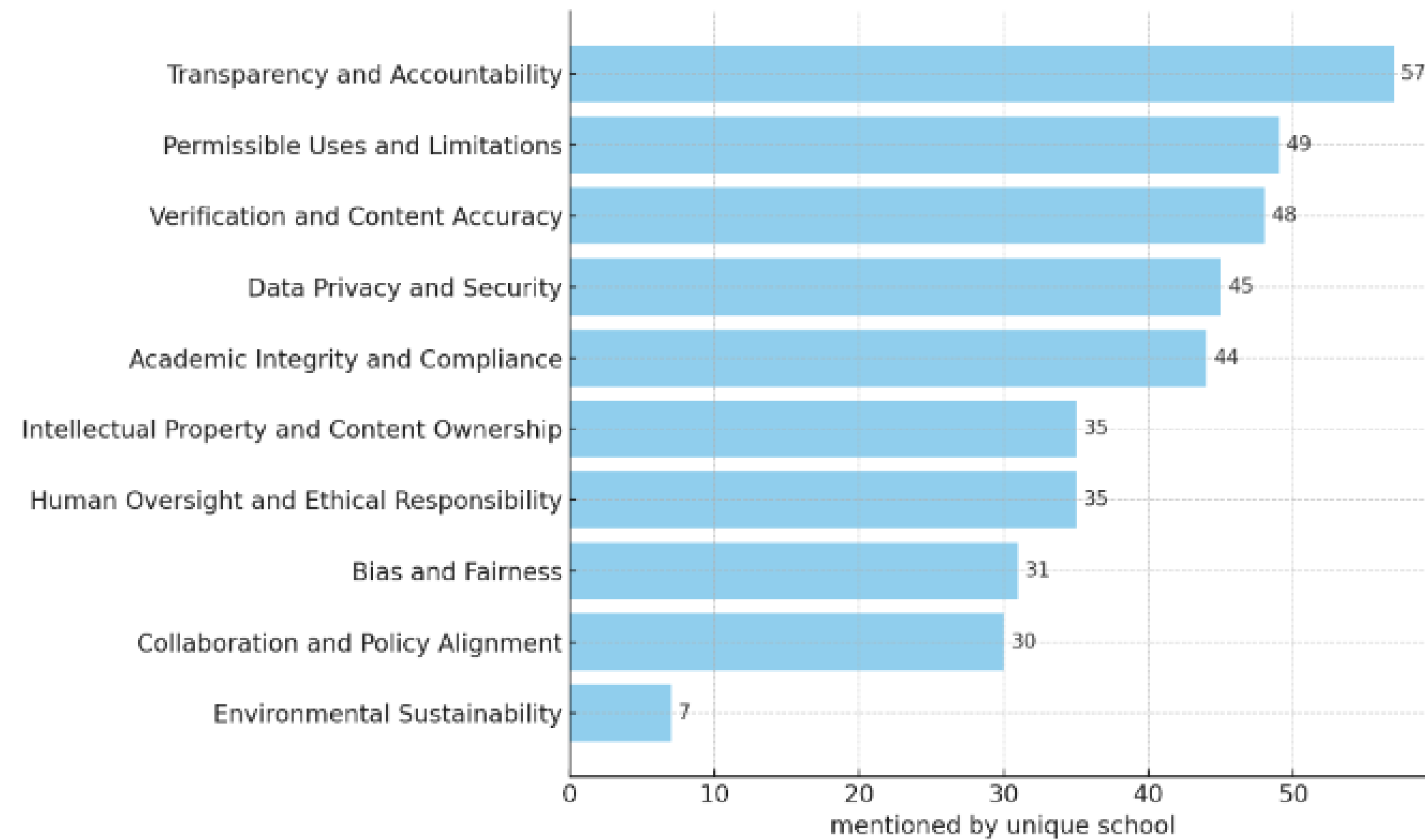


Figure 3: Frequency of Themes in Research Policies of 61 Higher Education Institutions



Generative AI for Research Initiative

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 English

 中文

This initiative collects and evaluates generative AI tools for research. Our focus is on providing a platform for researchers to discover and utilize generative AI technology in their research projects correctly and responsibly. [Bookmark this website now!](#)

Aug 24

Research

Researchers Find AI Chatbot GPT Effective for...

Jul 21

Research

Generative AI for Economic Research: Use Cases and...

Jul 13

Workshop and seminar

Workshop review: Large Language Models (LLMs) in...



 Let's Chat!





## Toolkit

Check the comprehensive Generative AI toolkit for effective research



## Workshop and seminar

Check the workshop and seminar about generative AI here



## Course

Follow a course to develop your skills in using generative AI



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## Research

Check recent research findings related to Generative AI



## Journal policy

Check journals' policy regarding the use of generative AI in publications

<http://GAIforResearch.com>

Generative AI for  
Research





## University policy

Check the GenAI policy of top 100 universities around the world



## Responsible use

Check the recommendation for responsible and ethical use of generative AI for research



## Chat with Mimi

Chat with Mimi to find more specific information about which tool to use for your research

<http://GAIforResearch.com>

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