

---

# Artificial Intelligence

Tut 1/ week1

---

# Outline

- Definition of AI and approaches
  - Foundations and history
  - State-of-the-art and future
  - Key AI problem: Search
- 
- Assignment 0 & preparation for Assignment 1

# Activity 0: warm up

- Who are they?



Faces generated by GAN, NVIDIA  
<https://youtu.be/G06dEcZ-QTg>

# Activity 0: warm up

- What is this?



Human AI: <https://deepdreamgenerator.com/>

# Activity 1

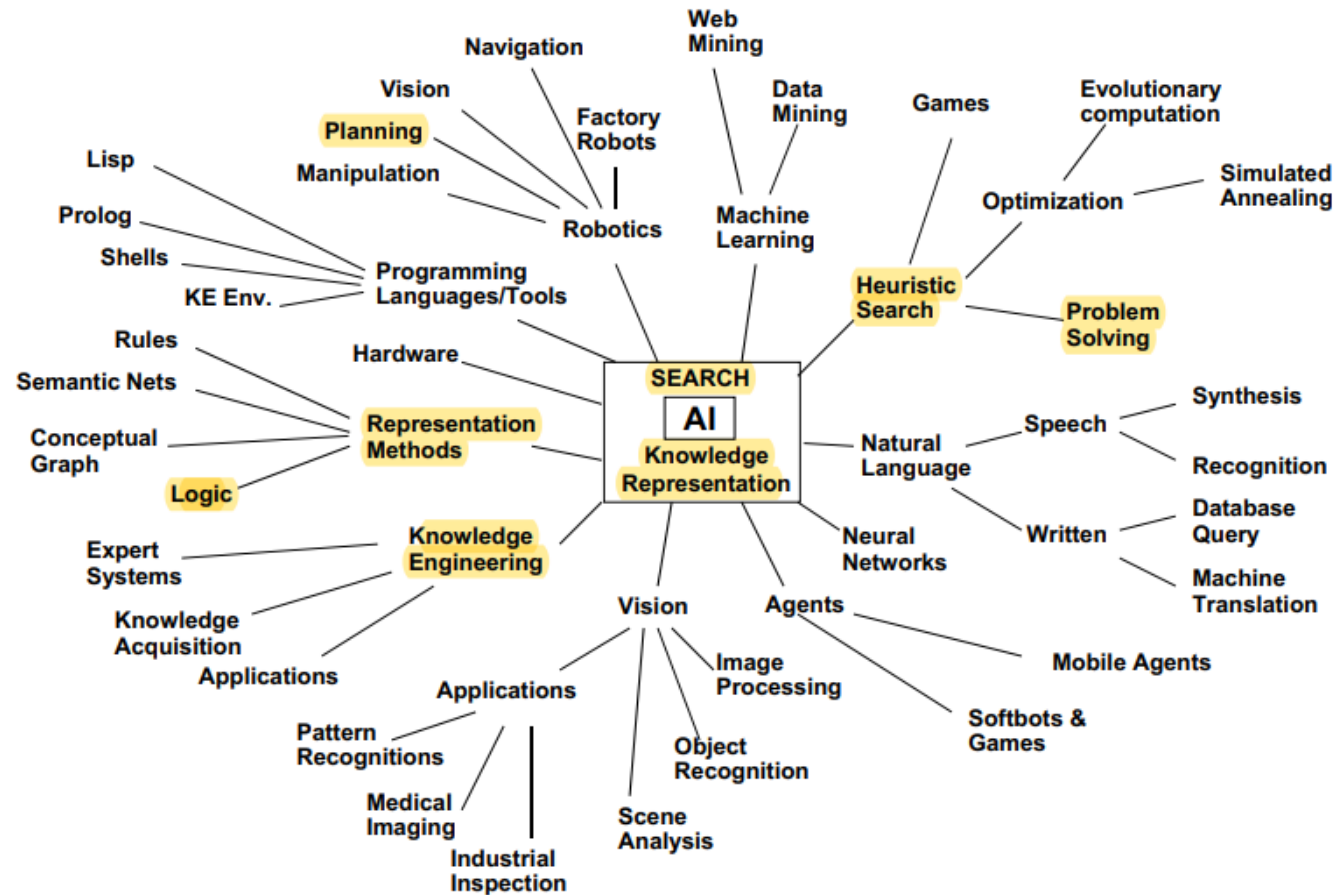
- What are an AI application that you have heard about/used?
- What is your current “AI knowledge”?
- What are your interests or hobbies?

# Activity 1

1. What is intelligence?
2. What is Artificial Intelligence?
3. How can a computer play chess?
4. How to represent intelligence?



# An overview of AI topics



# What to expect?

## Course Objectives

---

- ❑ AI is cross-disciplinary, covering a huge variety of subfields ranging from scientific research to real-world applications.
- ❑ This course only introduces to the **basic concepts and techniques** of AI, leaving advanced topics for self-exploration or the undertaking of advanced courses.
- ❑ This course will help you gain AI-based problem solving skills that have applicability to a wide range of real-world problems.
- ❑ Basic concepts (and techniques) lays foundations for the success of in-depth studies and even job interviews.



# Activity 2

- Can AI be creative?
- Can AI be empathetic?

# Can AI be creative?

**Summary:** Artificial Intelligence (AI), specifically GPT-4, was found to match the top 1% of human thinkers on a standard creativity test. The AI application ChatGPT, developed using GPT-4, excelled in fluency and originality in the Torrance Tests of Creative Thinking, a widely recognized tool for assessing creativity.

This breakthrough finding indicates that AI may be developing creative ability on par with or even surpassing human capabilities. Dr. Erik Guzik, the lead researcher, anticipates that AI, with its rapidly evolving advancements, will become a key tool for business innovation and entrepreneurship.

## Key Facts:

1. The study showed that ChatGPT performed in the top 1% for originality, a new achievement for AI.
2. AI outperformed the majority of college students in the national creativity test.
3. Despite ChatGPT's success, it suggested the need for more sophisticated tools to differentiate between human and AI-generated ideas.

# Can AI be empathetic?

## THE WALL STREET JOURNAL.

customer service—and your performance review

By Lisa Bannon

Oct. 7, 2023 9:02 am ET

 SHARE  TEXT

46 RESPONSES 

 **Listen to article** (10 minutes)

[Explore Audio Center](#)

Busy, stressed-out humans aren't always good at expressing empathy. Now computer scientists are training artificial intelligence to be empathetic for us.

AI-driven large language models trained on massive amounts of voice, text and video conversations are now smart enough to detect and mimic emotions like empathy—at times, better than humans, some argue. Powerful new capabilities promise to improve interactions in customer service, human resources, mental health and other fields, tech experts say. They're also raising moral and ethical questions about whether machines, which lack remorse and a sense of responsibility, should be allowed to interpret and evaluate human emotions.

# Discussion

- You've heard:
  - Creativity sets humankind apart from and above all others
  - Creativity is humanity's only advantage against AI
  - Empathy, typically regarded as a uniquely human trait, refers to the ability to understand and share the emotions of others.
- ...
- Can AI experience emotions?
- Can AI truly understand suffering or joy?

# Discussion

- It is possible for AI to learn how to detect emotions and demonstrate empathy
- AI systems can respond to you in the most “compassionate” way (it decides from the data it has learnt)
- Because empathy can be learned, artificial Intelligence can surely be equipped with artificial empathy in the years to come (Jun Wu, Forbes, 2019)
- Now: 2024-2025
  - AI can be creative
  - AI can show empathetic

# What is AI?

- The science of making machines that:

<b>Think like humans</b>	<b>Think rationally</b>
<b>Act like humans</b>	<b>Act rationally</b>

- What is an intelligent agent?

# Rational Decisions

- The term **rational** is used in a very specific, technical way:
  - Rational: **maximally achieving pre-defined goals**
  - Rationality only concerns what decisions are made (not the thought process behind them)
  - Goals are expressed in terms of the **utility** of outcomes
- Being rational means **maximizing your expected utility**.

A better title for this course would be:

**Computational Rationality**



# Activity 3

- What AI can/can't do?
  - Play a decent game of table tennis?
  - Play a decent game of Jeopardy?
  - Drive safely along a curving mountain road?
  - 🔍 Drive safely along Telegraph Avenue?
  - Buy a week's worth of groceries on the web?
  - ✗ Buy a week's worth of groceries at Berkeley Bowl?
  - 🔍 Discover and prove a new mathematical theorem?
  - ✗ Converse successfully with another person for an hour?
  - 🔍 Perform a surgical operation?
  - Put away the dishes and fold the laundry?
  - Translate spoken Chinese into spoken English in real time?
  - ✗ Write an intentionally funny story?
- 2022

# Activity 3

- What AI can/can't do?
  - Play a decent game of table tennis?
  - Play a decent game of Jeopardy?
  - Drive safely along a curving mountain road?
  - 🔗 Drive safely along Nguyen Van Linh Avenue?
  - Buy a week's worth of groceries on the web?
  - Buy a week's worth of groceries at Shopee?
  - 🔗 Discover and prove a new mathematical theorem?
  - Converse successfully with another person for an hour?
  - 🔗 Perform a surgical operation?
  - Put away the dishes and fold the laundry?
  - Translate spoken Chinese into spoken English in real time?
  - Write an intentionally funny story?
- 2025!

# Weak AI vs Strong AI

- Strong AI (AGI)
  - How do humans learn?  
from experience
- Weak AI (narrow AI)
  - Can play chess but can't walk or make coffee

# Weak AI vs Strong AI

## Weak AI

- Focuses on performing a specific task
- Can perform one type of task
- Lacks human consciousness, but can simulate it sometimes
- Result is predictable
- Achievable and achieved now.

## Strong AI

- Can perform a variety of functions
- Teaches itself to solve new problems
- Develops a human-like consciousness
- Result is not predictable
- For now more a vision.

# Activity 4

- **Practical Examples of Weak/Narrow AI?**
  - Play chess (search)
  - Digital voice assistants (Siri, Alexa)
  - Image and speech recognition
  - Recommendation engines
  - Search engines
  - Chatbots
  - Autonomous vehicles
  - Robots
  - ...

# GAI, AGI & ASI

- What is GAI?
- Available, advanced significantly
- What is AGI?
- Complex and evolving field
- What is ASI?
- Doesn't exist

# State-of-the-art

## Select AI Index technical performance benchmarks vs. human performance

Source: AI Index, 2025 | Chart: 2025 AI Index report

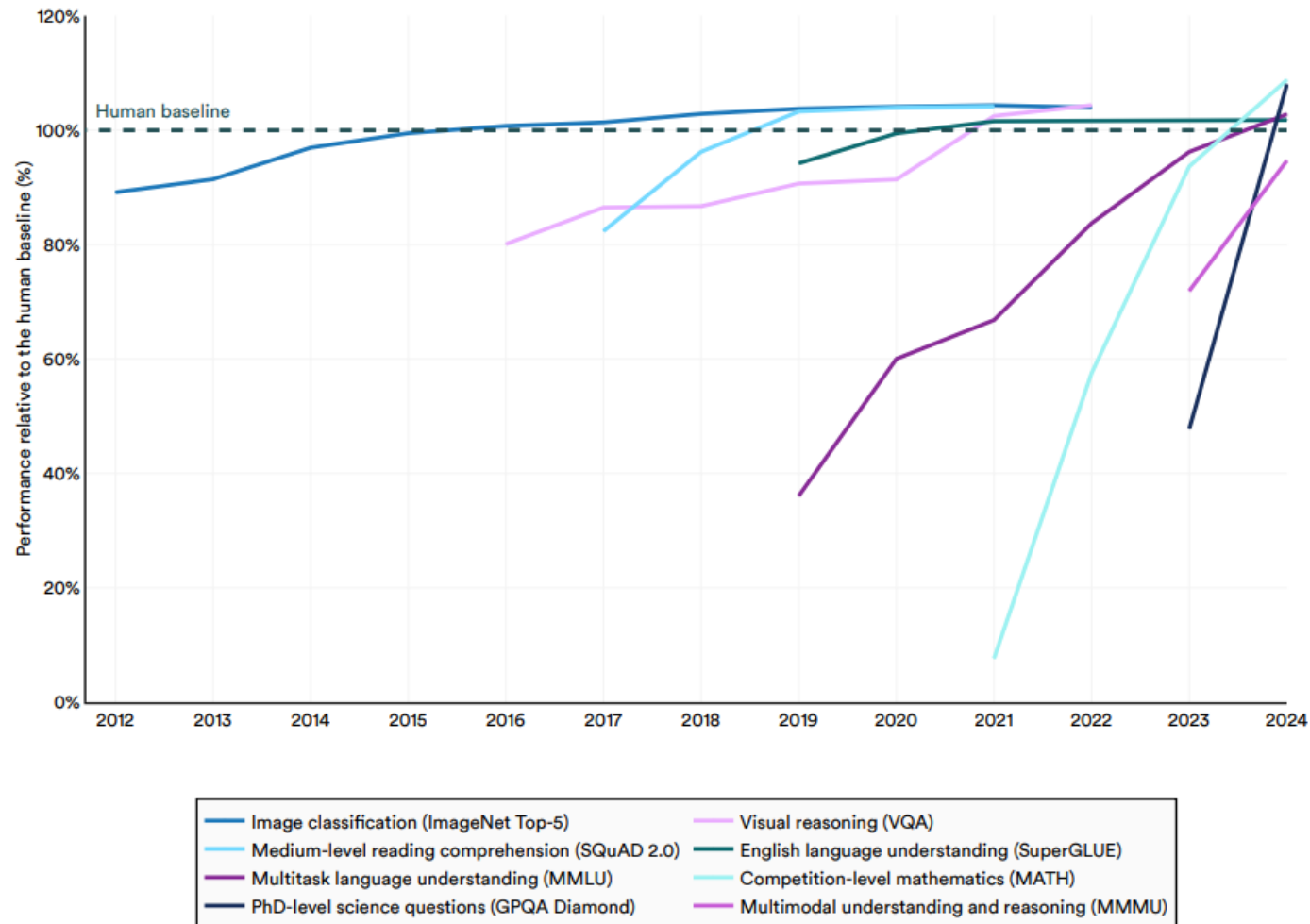


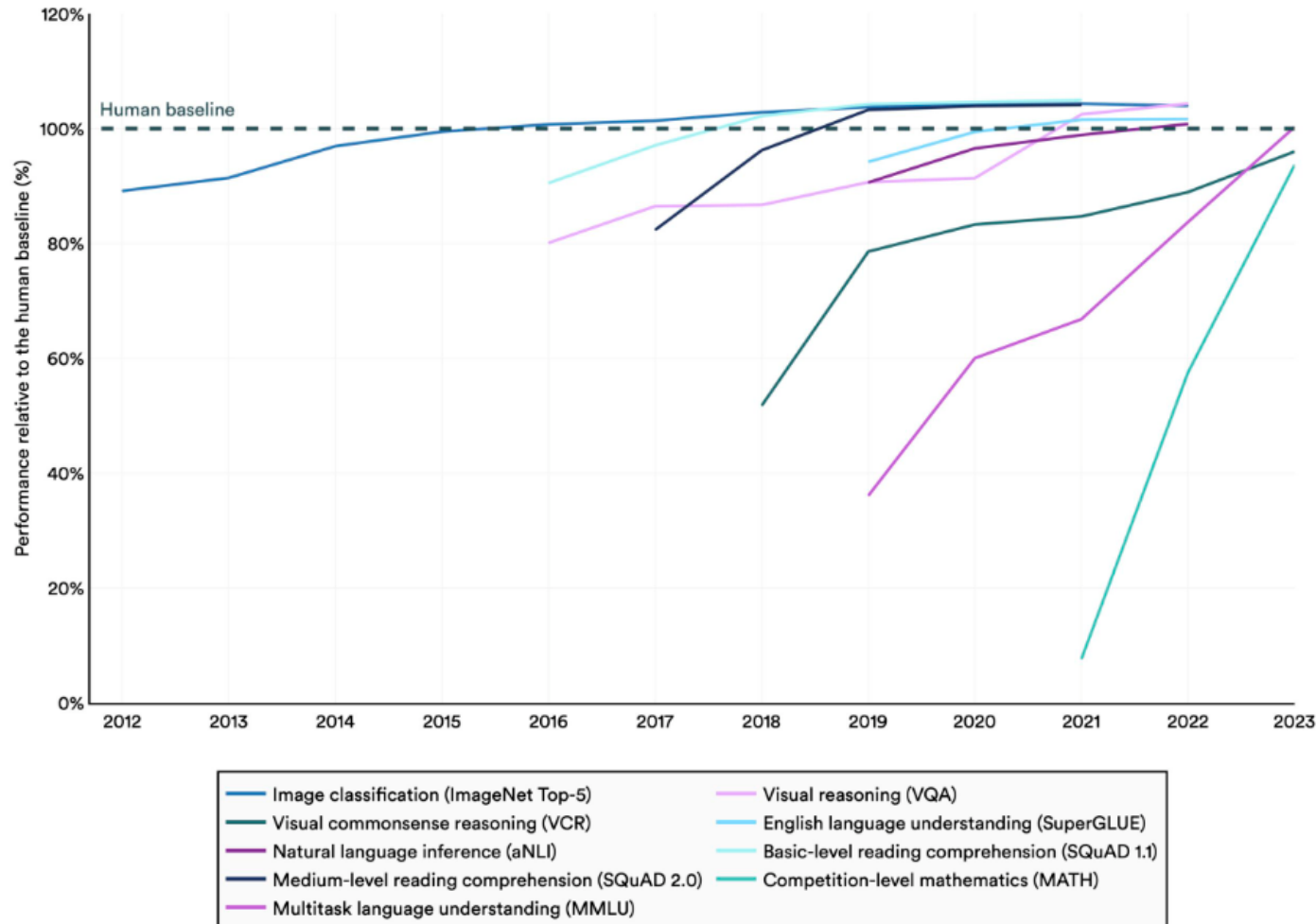
Figure 2.1.33



# State-of-the-art, AI Index Annual Report 2024

## Select AI Index technical performance benchmarks vs. human performance

Source: AI Index, 2024 | Chart: 2024 AI Index report



# State-of-the-art

## Performance of top United States vs. Chinese models on LMSYS Chatbot Arena

Source: LMSYS, 2025 | Chart: 2025 AI Index report

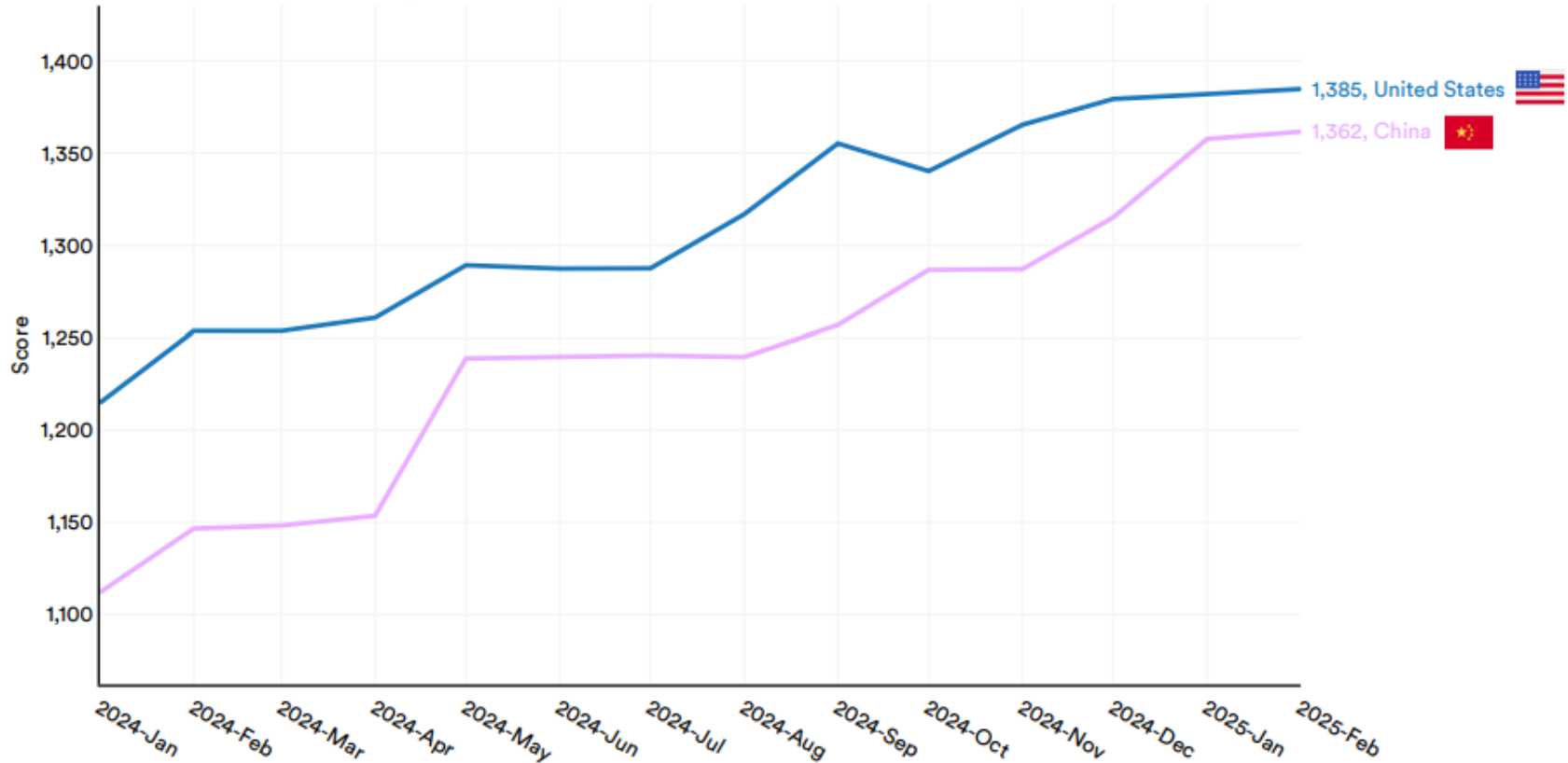


Figure 2.1.36

# State-of-the-art

## Performance of top models on LMSYS Chatbot Arena by select providers

Source: LMSYS, 2025 | Chart: 2025 AI Index report

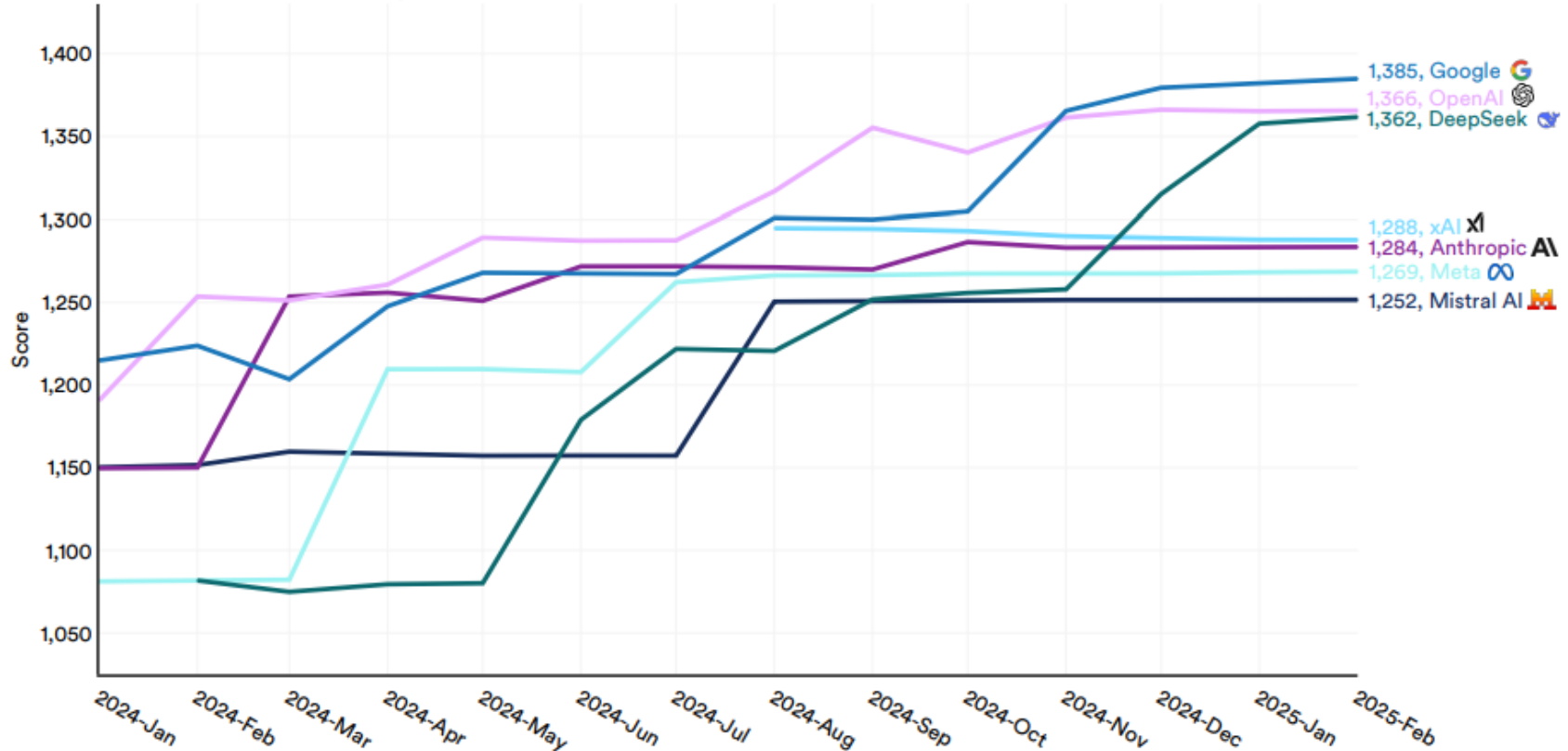


Figure 2.1.39

# State-of-the-art

## HHEM: hallucination rate

Source: HHEM leaderboard, 2025 | Chart: 2025 AI Index report

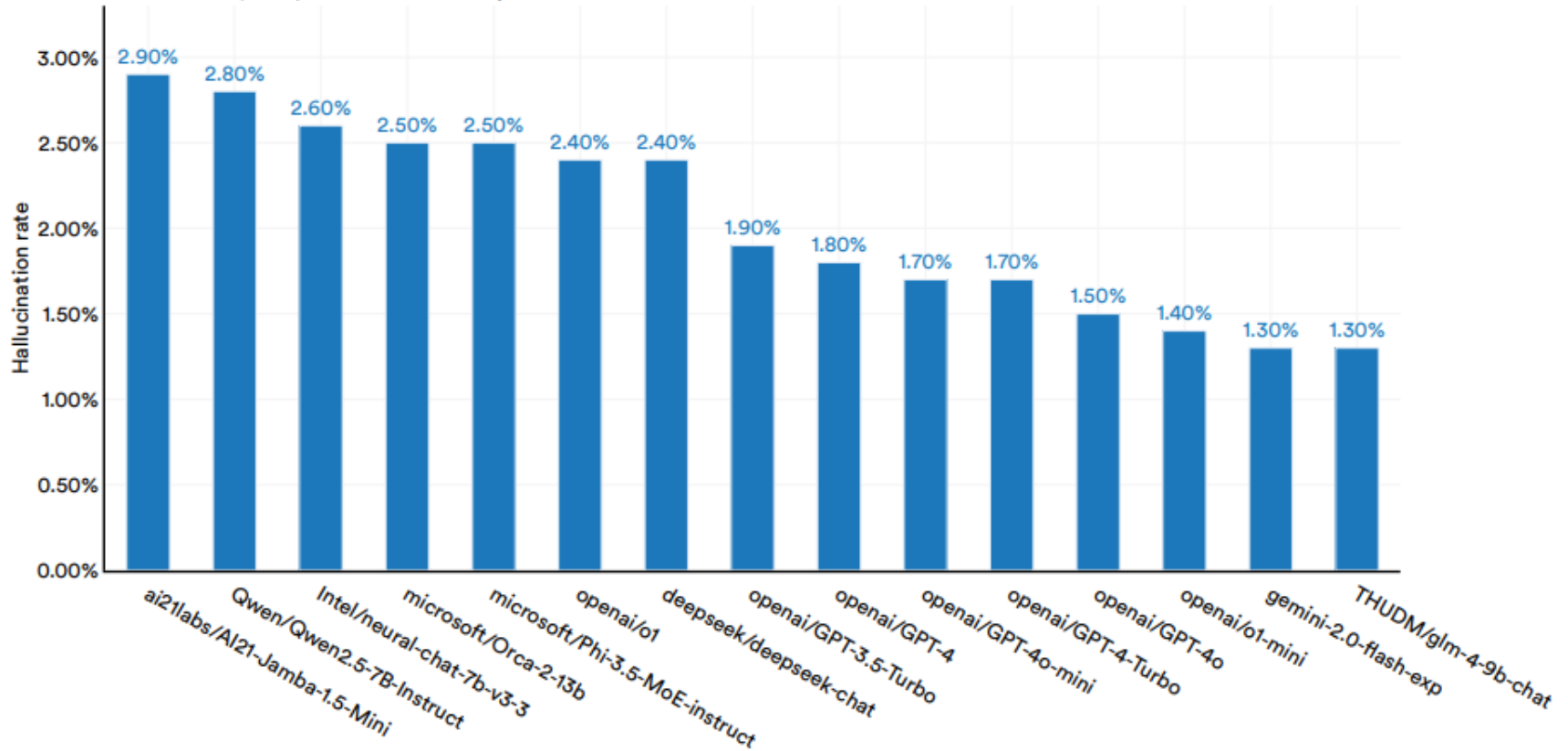


Figure 3.2.8

# Responsible AI

## Number of reported AI incidents, 2012–24

Source: AI Incident Database (AIID), 2024 | Chart: 2025 AI Index report

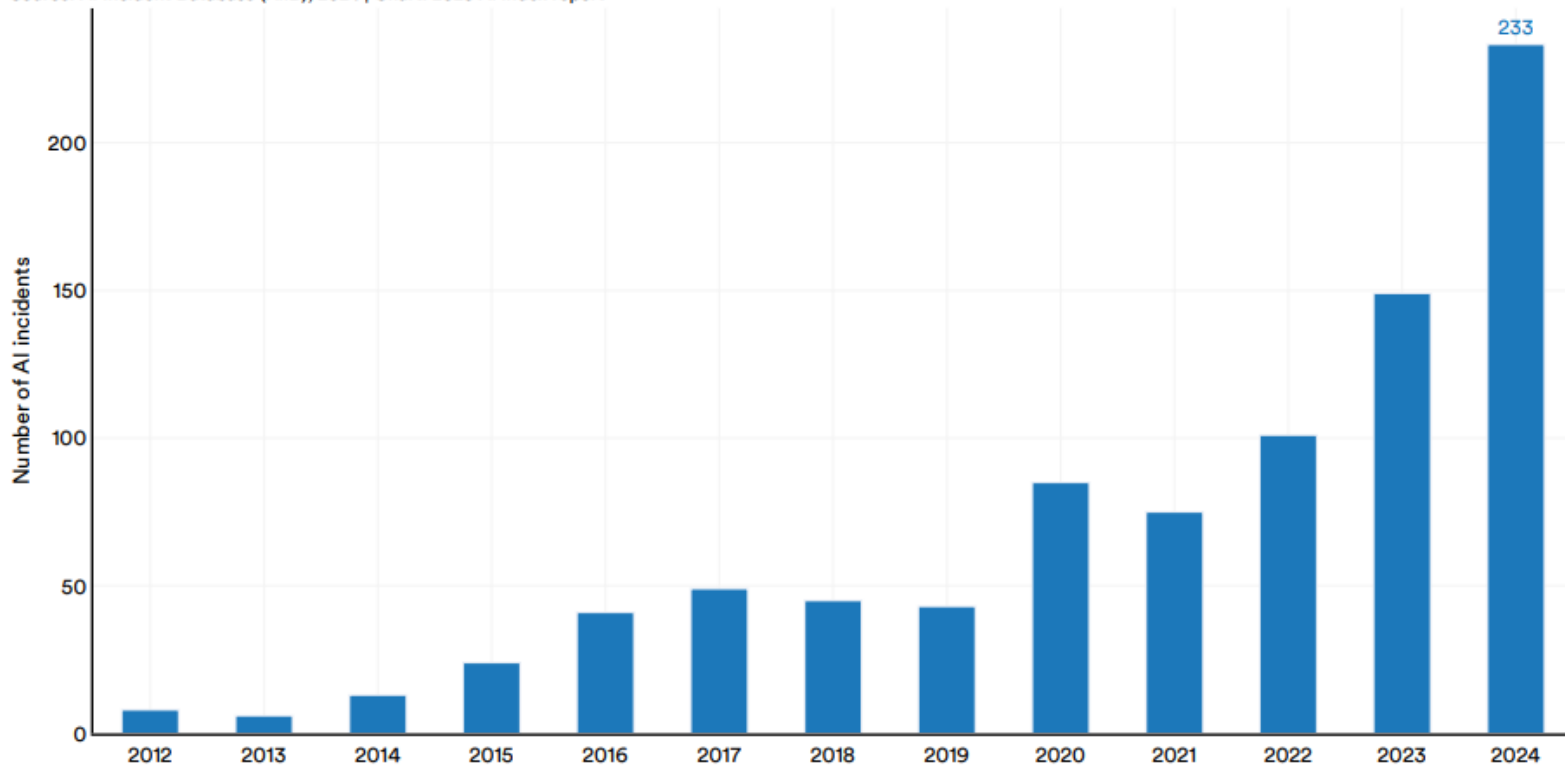


Figure 3.2.1<sup>1</sup>

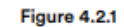
<sup>1</sup> The number of AI incidents is continually updated over time, including for previous years. Therefore, the totals reported in Figure 3.2.1 might not align with the more recent totals published on the AI Incident Database.

# What is the future of AI?

- McKinsey 5 charts
- AI Index Annual Report, 2024
- [https://hai.stanford.edu/assets/files/hai\\_ai\\_index\\_report\\_2025.pdf](https://hai.stanford.edu/assets/files/hai_ai_index_report_2025.pdf)

100

Source: Lightcast, 2024 | Chart: 2025 AI Index report





# AI job

## AI job postings (% of all job postings) in the United States by skill cluster, 2010–24

Source: Lightcast, 2024 | Chart: 2025 AI Index report

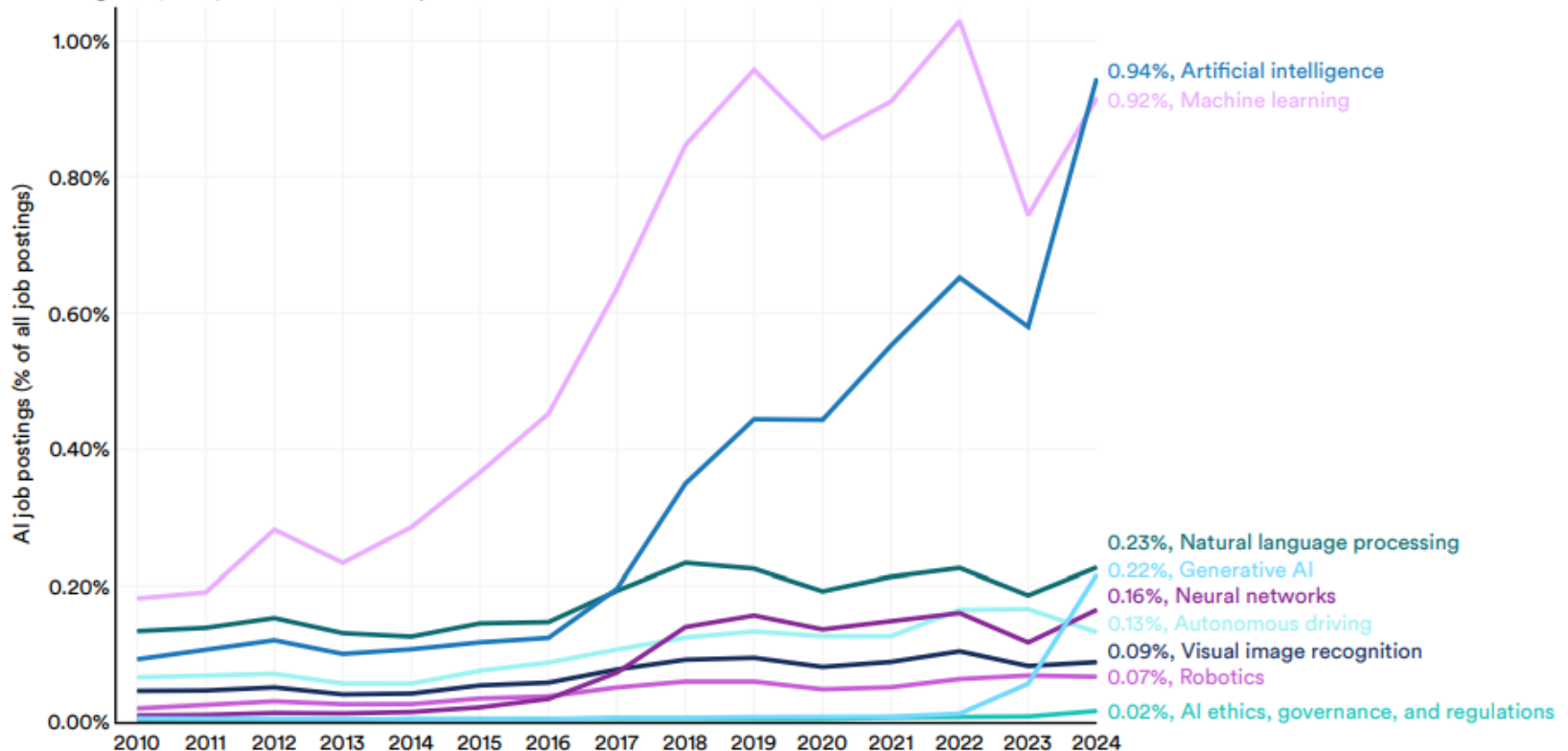


Figure 4.2.3'

# AI job

## Top 10 specialized skills in 2024 AI job postings in the United States, 2012–14 vs. 2024

Source: Lightcast, 2024 | Chart: 2025 AI Index report

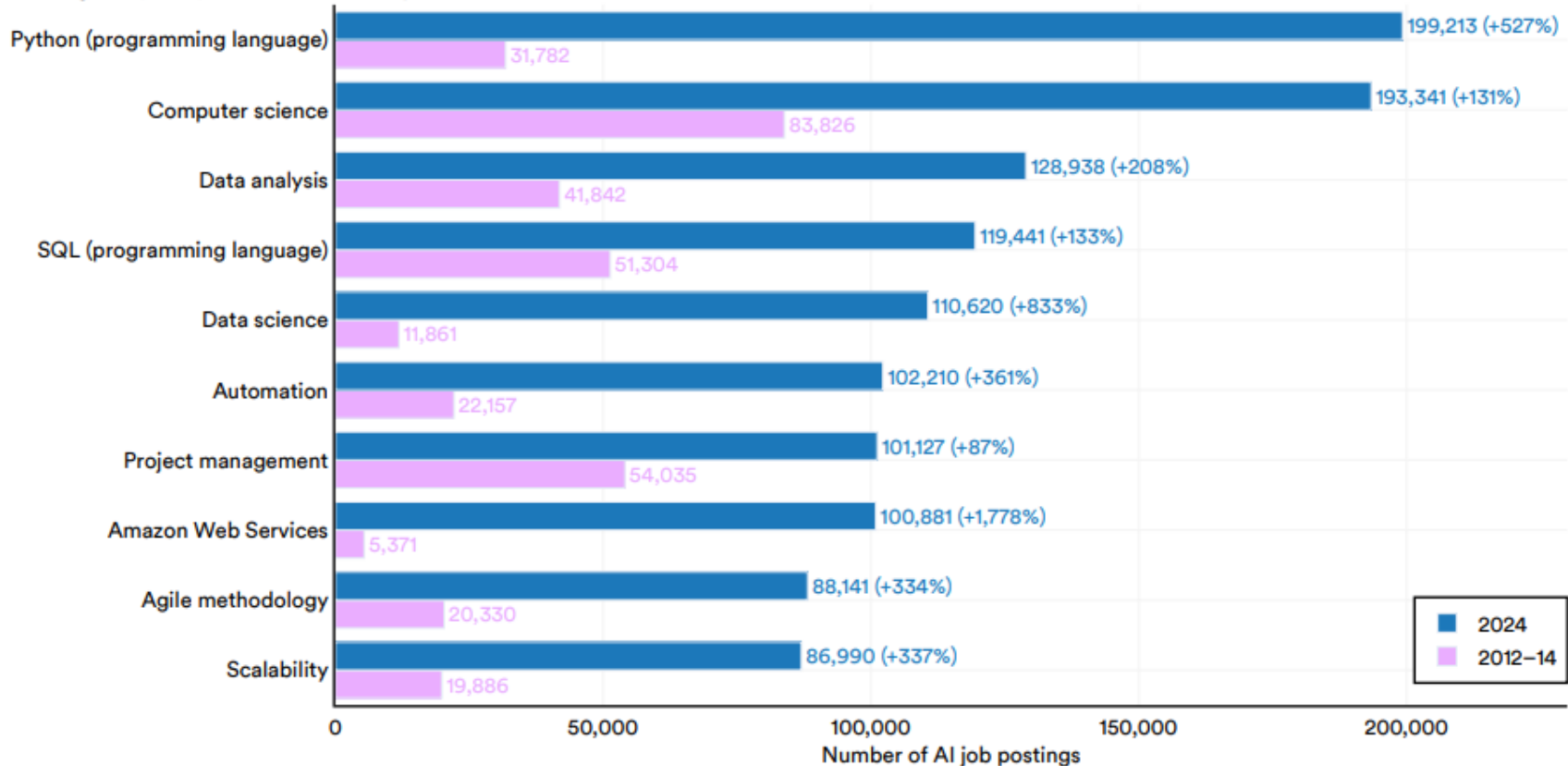


Figure 4.2.4

# AI Index Annual Report 2025

## Global private investment in AI by geographic area, 2013–24

Source: Quid, 2024 | Chart: 2025 AI Index report

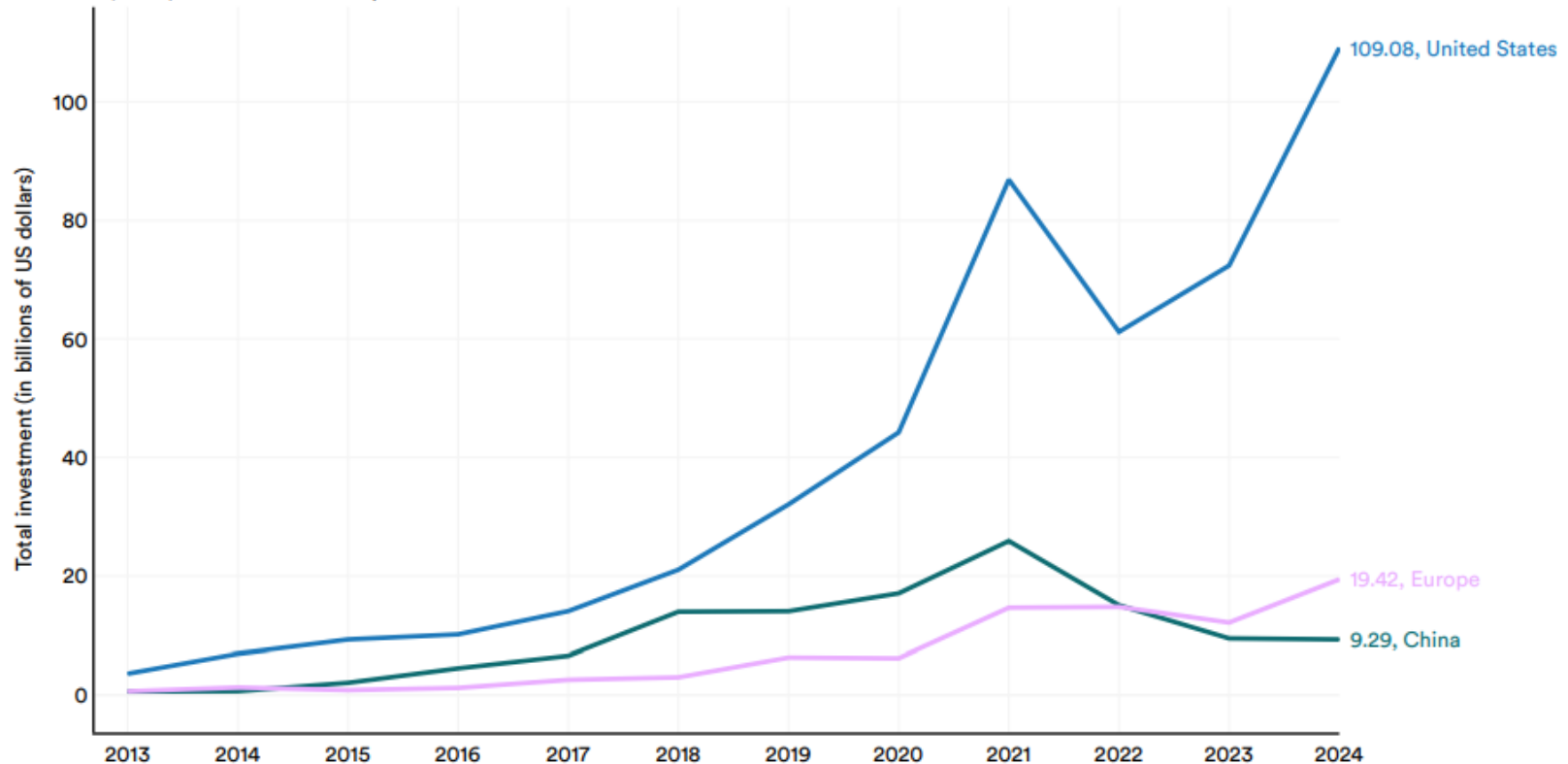
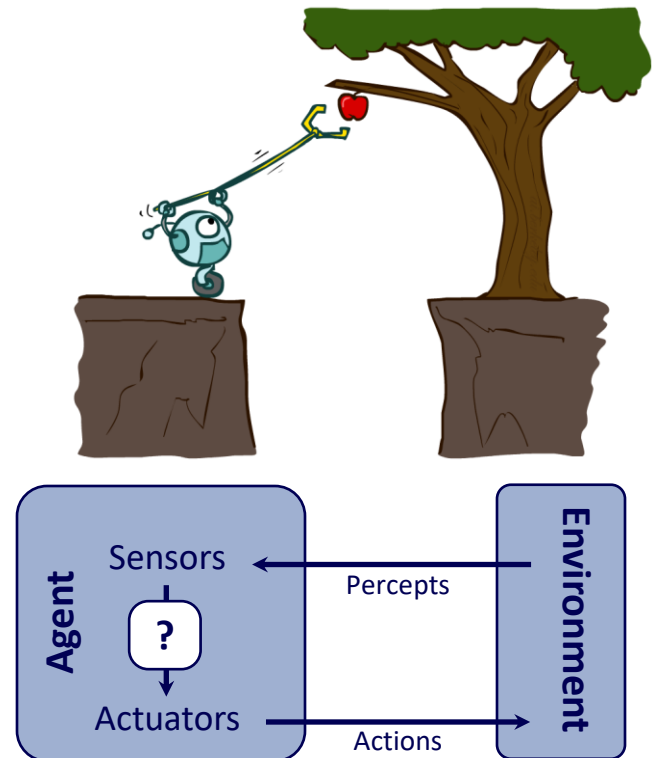


Figure 4.3.10

# Agent & Search

## Designing Rational Agents

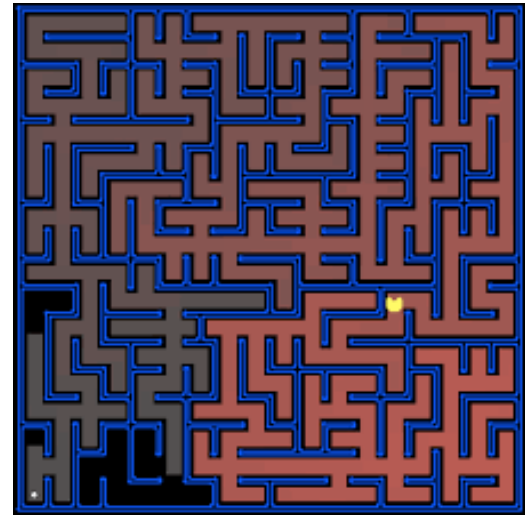
- An **agent** is an entity that *perceives* and *acts*.
- A **rational agent** selects actions that maximize its (expected) **utility**.
- Characteristics of the **percepts**, **environment**, and **action space** dictate techniques for selecting rational actions.



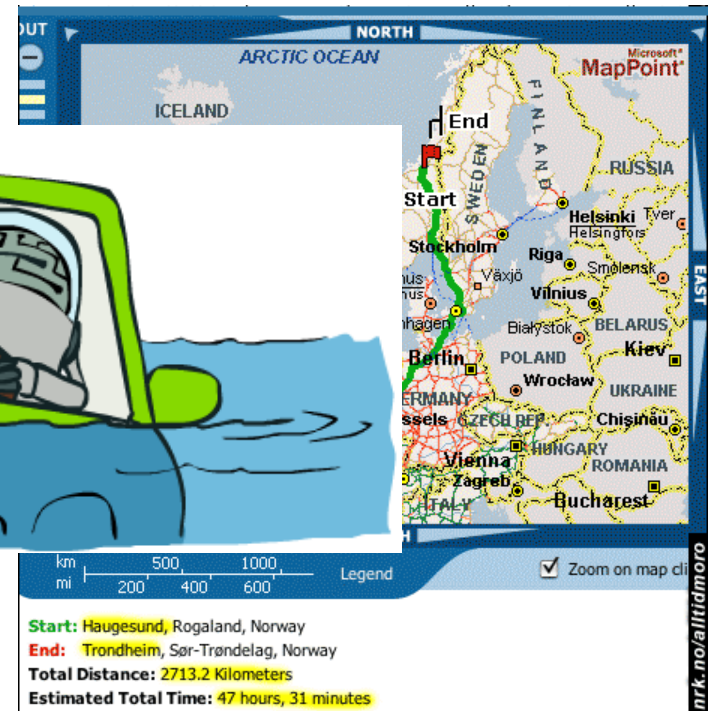
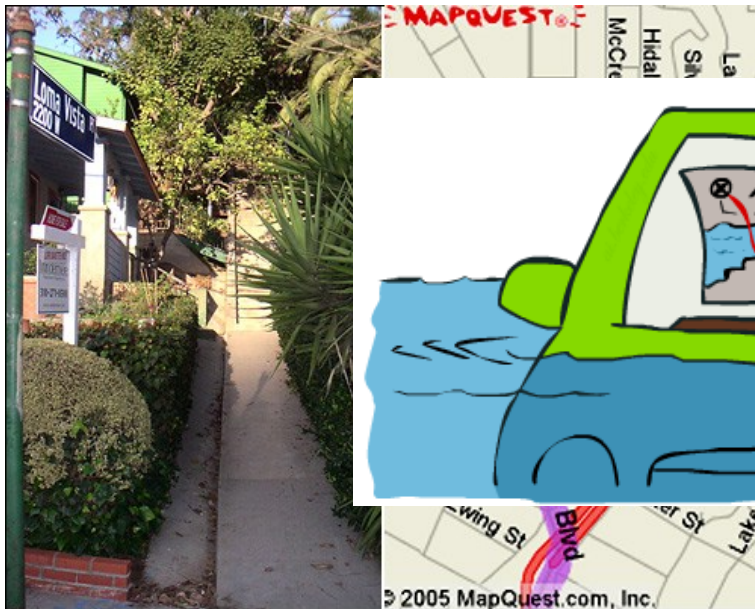
# Search

## Example: Pacman

- Goal:
  - Help Pac-man find his way through the maze
- Techniques:
  - Search: breadthfirst, depth-first, etc.
  - Heuristic Search: Best-first, A\*, etc.



# Search Gone Wrong?



# Python basic

- Assignment 0: Warm up
- Tutorial: [Python, Set up & Autograder Tutorial](#)



# Course materials

- Book: [Artificial Intelligence: A Modern Approach Russell & Norvig 4th global Pearson Ed](#)
- Book: [TOC of Artificial Intelligence: A Modern Approach, 4th Global ed](#)
- Dev.: [Python crash course](#)
- Textbook 2: [Introduction to Artificial Intelligence](#) by Nikhil Sharma, Josh Hug, Jacky Liang, and Henry Zhu.

# Task

- Assign 0: Python Tutorial
  - Online, no grade
  - Start NOW!
- Assign 1: Search
  - Coming soon...
  - Start early and ask questions.

**Question?**