

95-891: Introduction to Artificial Intelligence

Session 1: Introduction to the Course

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Agenda

- Introductions
- Course structure and policies
- What is AI?
 - Todai Robot
 - Google Duplex

Introductions: David Steier

- **CMU**: Computer science PhD, then research faculty
- **Price Waterhouse**: Director of R&D
- **Scient** and **Kanisa**: Executive positions
- **PwC**: Director of Center for Advanced Research
- **Deloitte**: Managing Director, Data Science
- **UC Berkeley**: Adjunct Lecturer and course lead, data science capstone
- **CMU**: Adjunct, then Distinguished Service Professor

Carnegie
Mellon
University

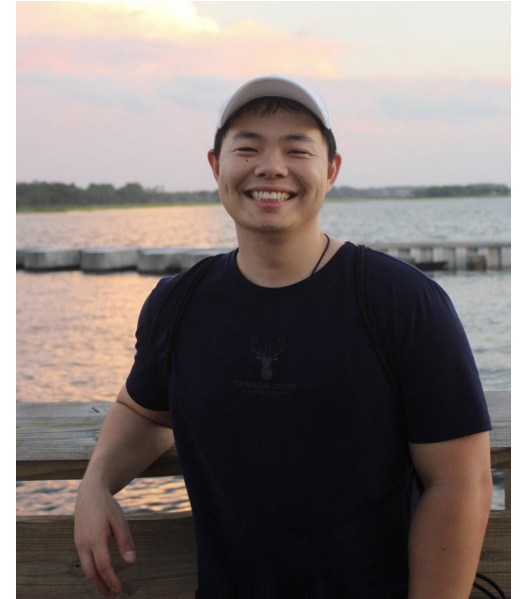


Carnegie
Mellon
University



Introductions: Yubo Li - TA

- Ph.D. Student in Information System, M.S. in Information System (BIDA track) at CMU, B.S. in Applied Mathematics at UCSD.
- 2025 Summer: Applied Scientist Intern @ Amazon.
- Email: yubol@andrew.cmu.edu.
- Office Hours: 10-11 am on Mon/Wed via Zoom
<https://cmu.zoom.us/j/92076006064>.
- Research Interest: LLMs for Healthcare, Recommendation Systems, Explainable AI.
- Hobbies: Watching documentary movies + LEGO.



Introductions: Xiaobin Shen - TA

- Ph.D. student in Information Systems @ Heinz, CMU
- BS in Information Systems @ Zhejiang University, MISM-BIDA @ CMU
- 2024 Summer: MLE intern @ Adobe
- 2025 Summer: PhD SWE (ML) intern @ Uber
- Email: xiaobins@andrew.cmu.edu
- Research: ML for Healthcare, Survival Analysis, Causal Inference
- Hobbies: Photography, Cooking
- Feel free to reach out to me!

Introductions: Yingtao Luo- TA



- Ph.D. student in Machine Learning and Public Policy @ CMU
- M.S. in Machine Learning Research @ CMU
- Research: (1) Sequential Decision-Making Agent based on DRL; (2) Medical Data Science Copilot System based on Agentic LLM system.
- Email: yingtaol@andrew.cmu.edu
- Office Hours: 5-6 pm on Thursday/Friday via [Zoom](#)
- Welcome to reach out for anything related to the course and beyond!

Introductions – Your Turn

- Name
- Department / Program
- Hometown
- Any expectations/goals for the class you'd like to share (optional)
- Fun fact to help us remember you (optional)

Overview of the Class

- **Questions addressed**

- How does AI work?
- How should we use AI?
- What will be the impact of AI on society?

- **Prerequisites**

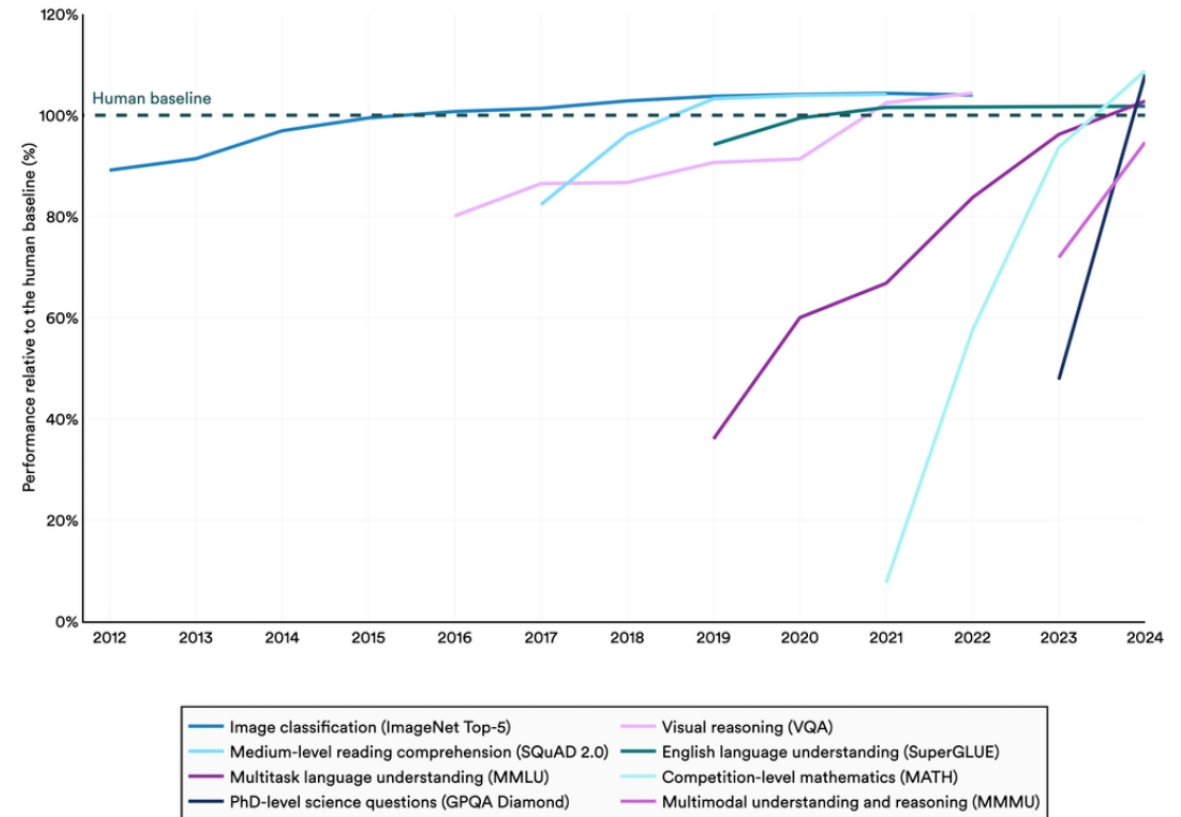
- A basic knowledge of statistics and some programming knowledge
- Prior exposure to Python and machine learning helpful

How Does AI Work?

- AI systems are outscoring humans on benchmarks for a range of tasks
- The pace of AI progress is increasing
- Even experts can't agree on why AI produces certain results

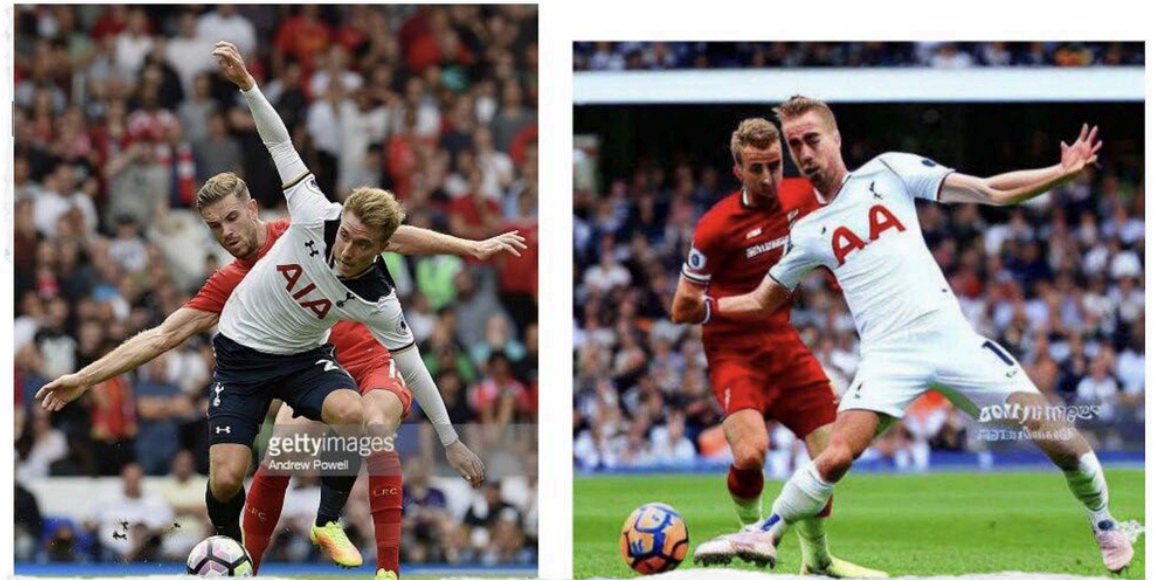
Select AI Index technical performance benchmarks vs. human performance

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



How Should We Use AI?

- What problems should we try to solve with AI?
- Do we have the right data for AI?
- How can we use AI and respect intellectual property rights?
- Can we make AI systems reliable and trustworthy?
- What platforms should we use to build AI systems?
- What are sustainable business models for AI?
- How should AI be governed?



Copyright Lawsuit over AI Generator

An illustration from Getty Images' lawsuit, showing an original photograph and a similar image (complete with Getty Images watermark) generated by Stable Diffusion.

Image: Getty Images

How will AI Impact Us as a Society?

- Does AI help or hurt productivity?
- Will AI destroy or create jobs?
- Will AI reduce or increase bias?
- Will AI reduce or increase privacy?
- Will AI increase or reduce economic inequality?
- Will AI help or destroy humanity?



<https://www.psycritic.com/2014/11/why-i-love-wall-e-and-question-aca.html>



<https://www.writeups.org/t800-terminator/>

95-891 Fall 25 Intro to AI Course Calendar

- Week 1 **Introduction to AI**
- Week 2 **Machine Learning**
- Week 3 **ML (continued)**
 - Quiz #1
- Week 4 **Deep Learning**
- Week 5 **Computer Vision**
- Week 6 **Natural Language Understanding**
- Week 7 **Large Language Models**
 - Midterm
- Week 8 **Improving Large Language Models**
 - Quiz #2
- Week 9 **AI Agents and Applications**
- Week 10 **AGI; Ethics in AI**
- Week 11 **Ethics in AI (continued); AI Governance**
 - Quiz #3
- Week 12 **Robotics; Infrastructure for AI**
- Week 13 **Futures of AI**
- Week 14 **Final Project Presentations**

Grading Policies

Description	Percent of Grade
Homework assignments	40% (8% x 5; lowest of 6 grades dropped)
Final project	21%
Three quizzes	9%
Midterm exam	10%
Class participation	20%

- Unless otherwise specified, assignments are to be done individually; not building on other classes
- Late work will be penalized by 10% per day
- Class participation = Session attendance, project contribution and discussion
 - Two absences (with notifications) excused
 - Missing three or more sessions impacts grade
- Class must be taken for a letter grade (no auditing or pass/fail or vouchers)
- Grading will be on a straight scale (no rounding up) as follows:

A+ 98.0-100%	B+ 88.0-89.9%	C+ 78.0-79.9%
A 92.0-97.9%	B 82.0-87.9%	C 72.0-77.9%
A- 90.0-91.9%	B- 80.0-81.9%	C- 70.0-71.9%

Homework Assignments

There will be 6 homework assignments, due at midnight (Eastern time)

Assignment	Due
Classification and clustering	Sep 16
Monte Carlo Tree Search	Oct 2
Computer vision	Oct 23
Natural language	Nov 6
Fairness in AI	Nov 20
Artificial General Intelligence	Nov 25

This is a Tier 3 Class in terms of GenAI

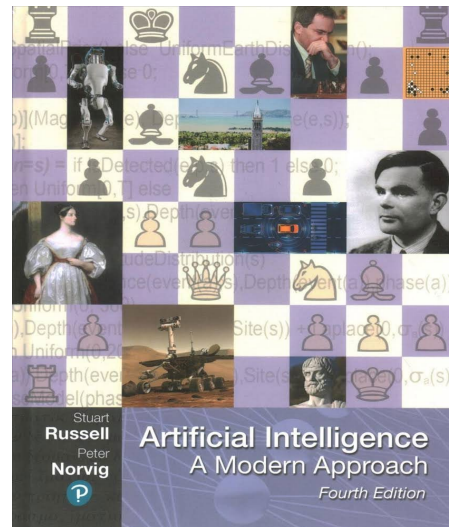
- Classes in Tier 3 teach technical skills and techniques with attention to advanced applications and real-world problem solving.
- Learning outcomes will include active engagement and skill building in the use of GenAI and other technical tools.
- Discussions may include conceptual or theoretical engagement with GenAI within specific work contexts, (ethical use, challenges, opportunities, emerging risks)
- Some assignments will prohibit the use of GenAI; others will require it. Detailed instructions will be given in each assignment.
- See the syllabus for more guidance.

Final Project

- Apply what you've learned from the class to a problem you choose:
 - Describe a problem that you think AI could help solve. Who would benefit from the problem being solved?
 - Find data source(s) if needed
 - Design and implement your solution
 - Describe your solution and results of your work
 - How well does your solution work?
- Project proposal due October 7
- Present in class Dec 2 or 4; final report due Dec 9
- Final projects may be done individually or in teams of up to 4 people.
 - If projects are done by a team, write-ups should describe who contributed which parts to each project

Course Reference

- Russell & Norvig, *Artificial Intelligence: A Modern Approach*, 4th edition, Pearson Education, 2020
 - See announcement on Canvas for different ways to access the text
- This text will be supplemented by on-line references per the syllabus.



Use of Python in this Class

- Python will be the working programming language of the course
 - Language for the assignments and the final projects
- Use the Python proficiency exercise to calibrate your preparation for the exercises in this course
- If you need extra preparation, you will have free access to the courses in [datacamp.com](https://www.datacamp.com) for the fall and part of the winter
 - Use the link
https://www.datacamp.com/groups/shared_links/e3841819d0ca6d331cbe5d5f22ba1e644218ecd8a67cb7ffa6cc2e80e14b71d6
with your Andrew ID (yourAndrewID@andrew.cmu.edu)

DataCamp Resources for Learning Python

- To get initial familiarity with Python (basics, lists, functions, methods, numpy)
 - <https://www.datacamp.com/courses/intro-to-python-for-data-science> (4 hours)
- To get familiarity with data visualization using matplotlib, and control flow in Python
 - <https://www.datacamp.com/courses/intermediate-python-for-data-science> (4 hours)
- To learn about control flow, more about functions and scoping in Python
 - <https://www.datacamp.com/courses/python-data-science-toolbox-part-1> (4 hours)
- To get some familiarity with statistics in Python
 - <https://www.datacamp.com/courses/statistical-thinking-in-python-part-1> (3 hours)
- To get more familiarity with statistics in Python
 - <https://www.datacamp.com/courses/statistical-thinking-in-python-part-2> (4 hours)

Todai Robot: AI or Not AI?



Essay question answered by Todai Robot:

“Discuss the rise and fall of the maritime trade in East and Southeast Asia in the 17th century in 600 words, taking into account the trade policies of East and Southeast Asian countries and the activities of European powers in the region.”

Noriko Arai, TED 2017, https://www.ted.com/talks/noriko_arai_can_a_robot_pass_a_university_entrance_exam

Poll: Do you think Todai Robot is an example of AI?

- A. Yes
- B. No
- C. Not sure



OpenAI's ChatGPT 5 “Thinking” model

- Maritime commerce in East and Southeast Asia surged in the early 17th century and then fragmented and reorganized by its end, shaped by Asian statecraft as much as by European intrusion. The first decades witnessed an unprecedented knitting together of Asian markets with American silver and European capital; the later decades saw monopolies, wars, and restrictive policies that narrowed older, more plural trading ecologies.
- The initial rise rested on Asian demand and Asian shipping. China's long-running appetite for silver, intensified by Ming fiscal reforms and monetization, drew bullion from Japan and the Americas into a web centered on the South China Sea. The Spanish Manila galleon (Acapulco–Manila) funneled New World silver to Southeast Asian entrepôts, where Chinese merchants exchanged silk, porcelain, and manufactured goods. Japanese exports of silver and copper, along with red-seal (shuinsen) voyages licensed by the early Tokugawa regime, fed ports such as Ayutthaya (Siam), Hoi An (Vietnam), and Patani (Malay Peninsula). Meanwhile, in the archipelago, spices—cloves, nutmeg, and mace—commanded high prices, and Muslim, Chinese, and Malay traders carried these goods across a lattice of relatively open ports
- European chartered companies amplified and then restructured this system. The Dutch VOC (1602) and English EIC (1600) arrived not as the primary movers of Asian trade but as political entrepreneurs with cannon and capital. The Dutch built Batavia (1619) as a coercive hub, seized Malacca (1641), massacred or expelled Banda's population (1621) to secure nutmeg, and crushed Makassar (1669), closing one of the last great free ports of the eastern archipelago. Their goal was not volume but control—enforced scarcity to sustain monopoly rents. The English, inferior in the spice game, pivoted toward Indian textiles, pepper from Sumatra, and later tea from China, using Southeast Asian ports as stepping stones rather than monopolized cores.
- State policy within Asia determined who could trade and on what terms. In Japan, the Tokugawa shogunate ended the outward-looking red-seal system with a series of “maritime prohibitions” (1633–1639) that expelled the Portuguese and confined foreign trade to Nagasaki under strict surveillance, with the Dutch and Chinese as permitted but tightly controlled partners. This did not end Japanese participation in maritime exchange, but it redirected it through a narrow institutional pipe that blunted private initiative and severed Japanese diaspora communities in Siam and Vietnam.
- In China, the mid-century collapse of the Ming and the Qing conquest (1644 onward) violently disrupted coastal commerce. To choke off the maritime regime of Zheng Chenggong (Koxinga) after he expelled the Dutch from Taiwan in 1662, the Qing imposed the “Great Clearance” (1661–1669), a forced evacuation of large stretches of the coast that devastated shipping, salt, and fisheries. Only after the Qing navy subdued Taiwan (1683) did the court lift bans and regularize overseas trade (1684–1685), opening designated customs posts. This late-century reopening helped restore long-distance flows—now under closer imperial supervision—setting the stage for the 18th-century Canton tea and silver circuits
- Southeast Asian monarchies alternated between openness and consolidation. Ayutthaya cultivated a cosmopolitan port in the early 1600s, hosting Dutch, English, Japanese, and Chinese communities; later, court politics and the 1688 revolution expelled most French influence and tightened royal control. In Vietnam, the Nguyễn in the south promoted Hoi An as an export gateway, but Japanese withdrawal after sakoku and regional warfare constrained its reach. On Sumatra and Java, polities like Aceh and Banten initially prospered by balancing Europeans and regional merchants; over time, VOC gunboats, treaties, and coups (Banten, 1682) diminished their autonomy and squeezed independent traders.
- By century's end, the “fall” was less a collapse than a hard pivot. The earlier, polycentric, merchant-led system gave way to a patchwork of monopolized islands (VOC spice zones), regimented chokepoints (Nagasaki), and newly bureaucratized corridors (Qing coastal customs). The Spanish-Chinese axis via Manila persisted, but under recurring tension toward Chinese merchant communities. European companies did not yet dominate overall volumes of intra-Asian trade, which remained largely in Asian hands; rather, they reshaped margins and routes where coercion paid. The net result was a contraction of free-port pluralism and a rise of state- and company-managed gateways. Those new constraints curtailed some 17th-century dynamism, but they also laid the institutional rails—monopoly contracts, coastal customs, disciplined port regimes—upon which the 18th-century expansion of tea, textiles, and porcelain would run

(40s to generate, 4m 47s to count the 703 words)

Google Duplex

- Allows automated assistants (like Google Assistant) to accomplish specific tasks on behalf of users through natural-sounding conversations over the phone
 - Booking a hair salon appointment
 - Making a restaurant reservation
- This capability benefits
 - Users who cannot use the phone to schedule appointments or are not available to talk during business hours
 - Businesses whose appointment system is not online (e.g. connected through OpenTable)

Google Duplex in Action



- Speaker 1: Hi, how may I help you?
- Speaker 2: Hi, um, I'd like to reserve a table for Wednesday the 7th.
- Speaker 1: For seven people?
- Speaker 2: Um, it's for four people.
- Speaker 1: Four people...when? Today, tonight?
- Speaker 2: Wednesday...at 6 PM.
- Speaker 1: Actually, we reserve for, like upwards of like five people. For four people you can come in.
- Speaker 2: How long is the wait usually to, uh, be seated?
- Speaker 1: For when? Tomorrow, or weekday, or...
- Speaker 2: For next Wednesday, the 7th.
- Speaker 1: Oh, no, it's not too busy, you can come for four people, ok?
- Speaker 2: Oh, I gotcha...thanks
- Speaker 1: Bye-bye.

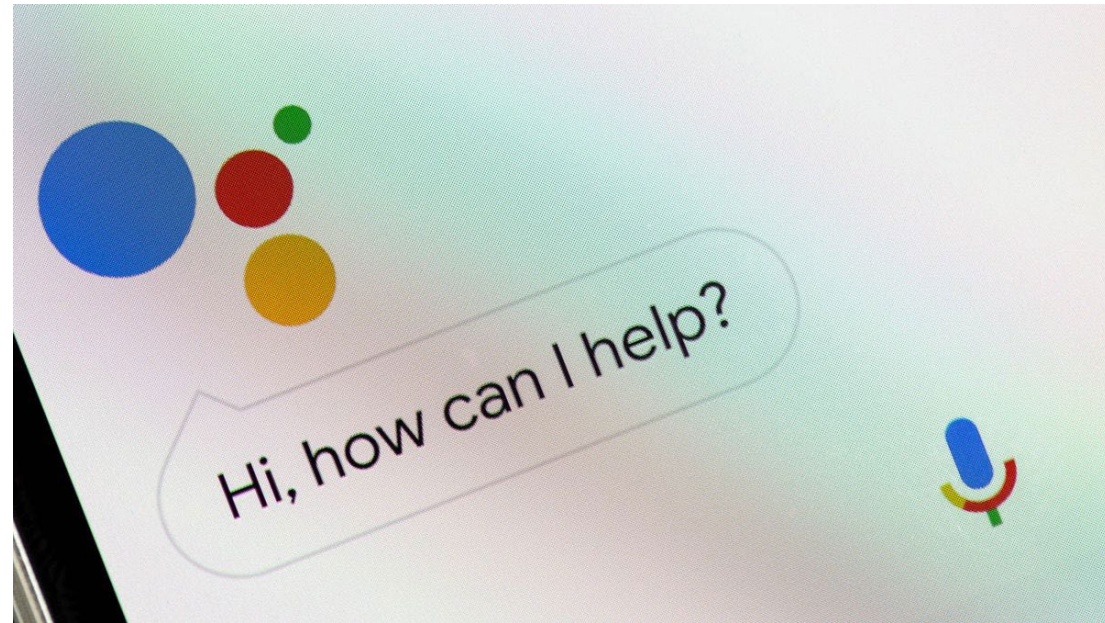
<https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html>

Features of Google Duplex

- **Uses disfluencies appropriately:** Neural network trained on many examples of actual interactions
 - Those interactions include “Mm..hmm” which people perceive as more natural conversational flow
- **Multiple voices:** Text to speech can mimic the style of multiple speakers on whose speech it is trained
- **Learning from feedback:** Operation is supervised by experienced trainers who can correct mistakes in real time, until system operates independently

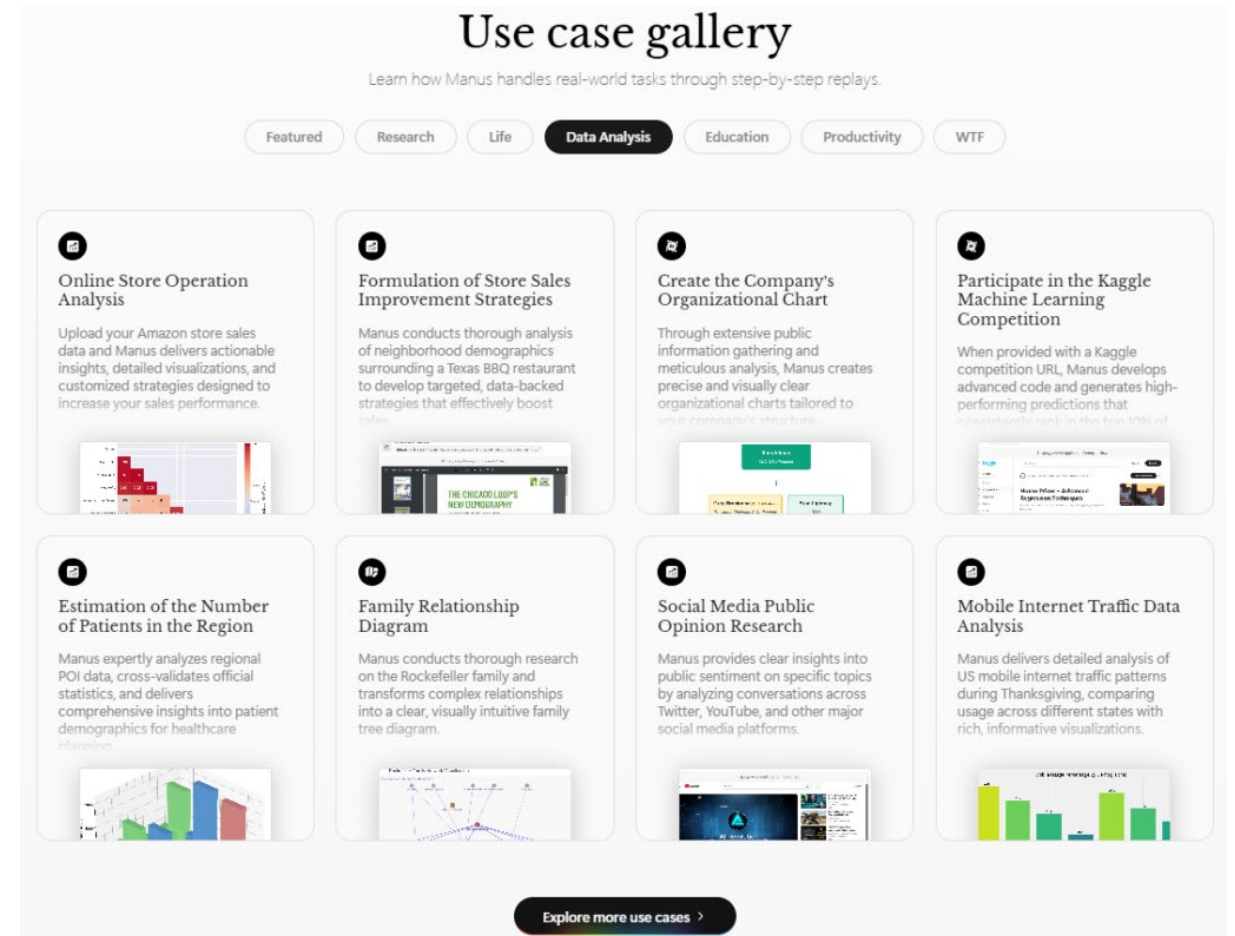
Poll: Do you think Google Duplex is an example of AI?

- A. Yes
- B. No
- C. Not sure

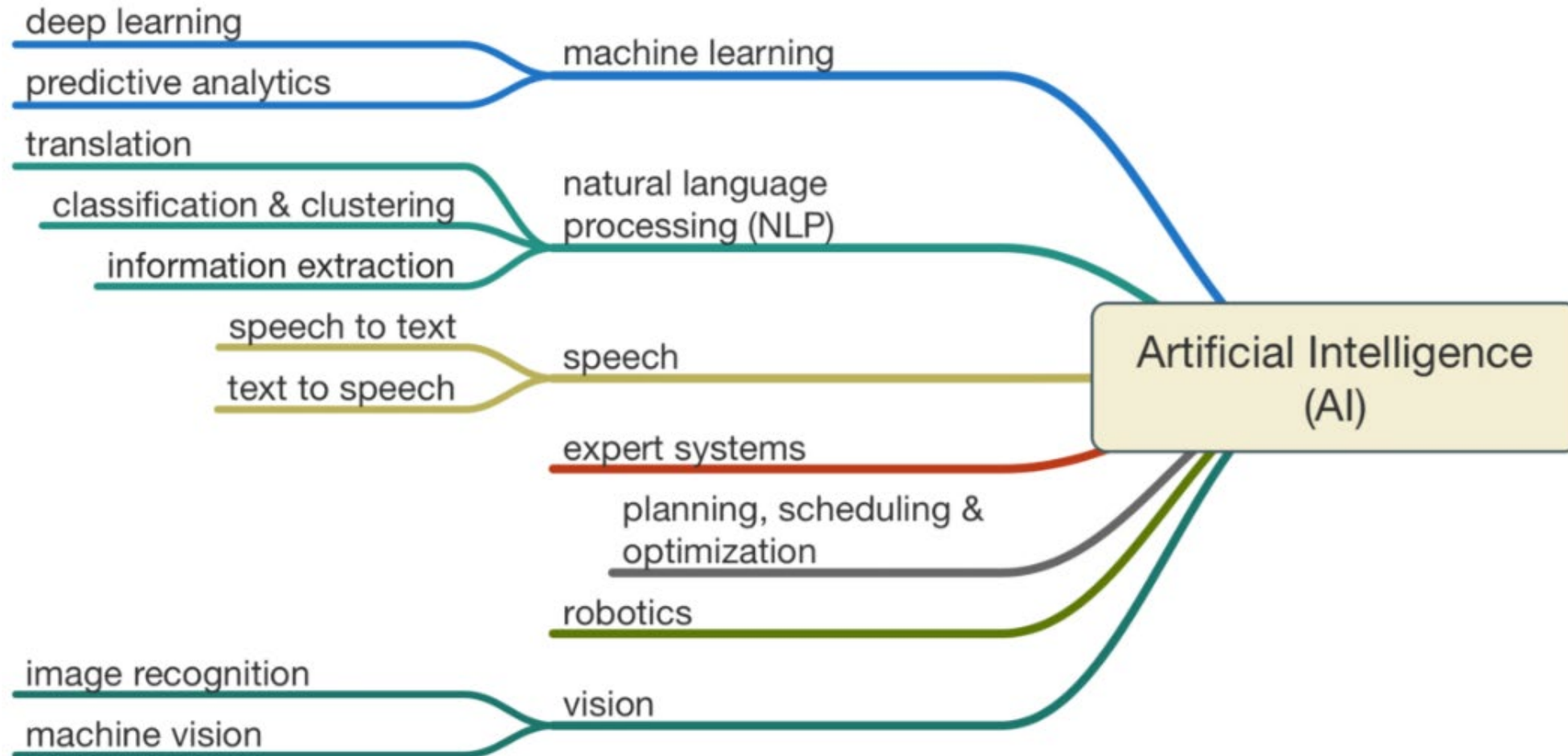


Manus (<https://manus.im/>)

- Developed by Chinese startup Monica; launched March 6, 2025
- Features
 - Autonomous task execution
 - Multi-modal capabilities
 - Advanced agent-based tool integration
 - Adaptive learning



AI Technologies We Will Cover in this Class



Kar, S., 2017, <https://medium.com/ml-ai-study-group/ai-mind-map-a70dafcf5a48>

Conclusion

- AI is often described as getting computers to do things that would be considered intelligent if done by humans
 - Since this definition is subjective, it may be more helpful to consider which capabilities of intelligence are used (reasoning, learning, language, etc.)
- Goal of the course is to introduce major capabilities of AI with a focus on how they are used in applications
- **Next class (August 28):** Proposing and evaluating AI applications
 - Start thinking of AI applications you want to work on for your final project