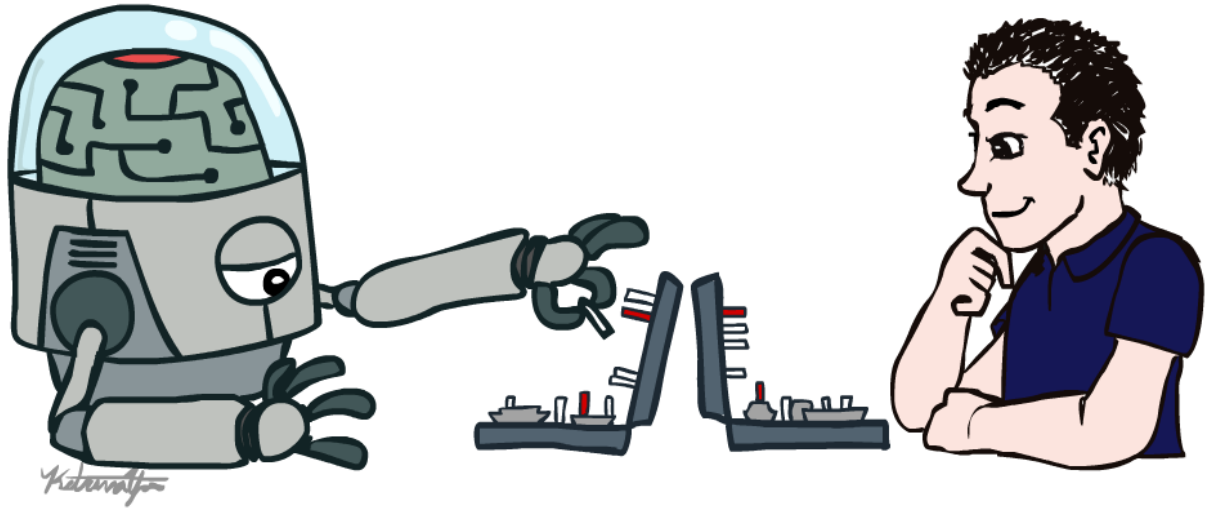
CS 188: Artificial Intelligence

Introduction



Spring 2023

University of California, Berkeley

[These slides were created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley (ai.berkeley.edu).]

First Half of Today: Intro and Logistics

- Staff introductions: Professor Russell, Peyrin, and course staff
- Course logistics
  - Lectures, discussions, office hours, and exams
  - Resources and communication platforms
  - Collaboration and academic honesty
  - DSP and extenuating circumstances
  - Stress management and mental health

Staff Introductions: Peyrin (he/him)

- Did my undergrad at Berkeley (2017-2021)
  - TA for 10 semesters (8x CS 161, 3x CS 61C, 1x CS 188)
  - Also been on staff for CS 61A, EE 16A, EE 16B
- Did a 5th year MS at Berkeley (2021-2022)
  - Research focus: computer science education
  - Advisors: Nicholas Weaver and Dan Garcia
- First-year lecturer in EECS
  - I'm paid exclusively to care about students and staff
  - First time teaching a non-summer class as instructor, so your feedback/advice/complaints are appreciated!
- Please call me "Peyrin"!
  - No "professor", "Mr.", "sir", "doctor", etc. I'm not paid enough for that.

Actual real picture of me.

Our talented course staff!

Xiangwei Kong
he/him

Tianjun Zhang

Suhong Moon
he/him

Simon Zhai

Sid Ijju
he/him

Shivana Anand
she/her

Sashrika Pandey
she/her

Rudy Corona
he/they

Our talented course staff!

Rishi Parikh
he/him

Nitish Dashora
he/him

Niklas Lauffer
he/him

Medhini Gulganjalli Narasimhan

Joy Liu
she/her

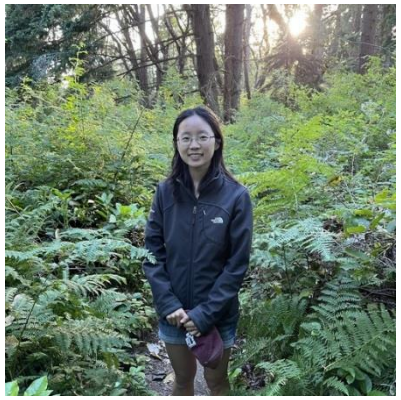
Jerry Sun
he/him

Hrish Leen
he/him

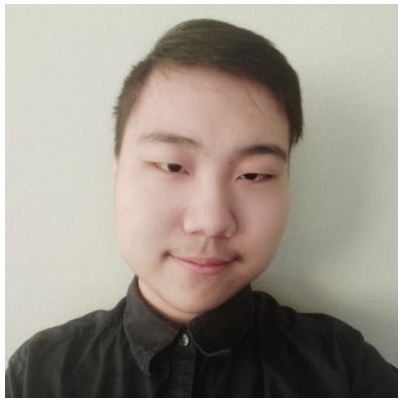
Evgeny Pobachienko
he/him

Our talented course staff!

Cham Yao



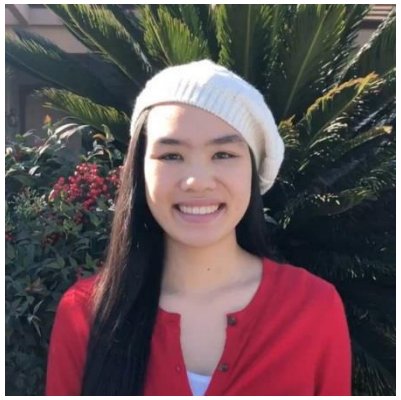
Catherine Chen
she/her



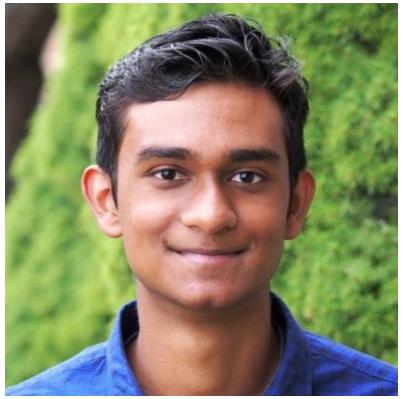
Anthony Han
he/him

Andrew Wang
he/him

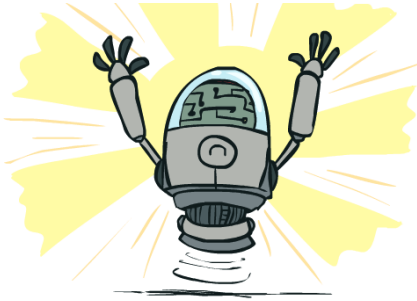
Andrew Qin
he/him



Alina Trinh
she/her



Ajay Sridhar
he/him



might have a few more people join so here's a placeholder

Enrollment

- Course staff does not control enrollment; we have to follow department policy
  - Only CS majors will be able to enroll this spring
  - More details on the course website

Course Structure: Lectures

- You are here!
- Tuesday/Thursday, 5:00–6:30 PM PT
- Attendance is not taken
  - But there may be a bit of extra credit for attending
- You can attend:
  - In-person in Wheeler 150
  - Remotely over Zoom (we'll try our best to livestream)
  - Asynchronously by watching recordings (posted on website)

Course Structure: Discussions

- We offer three types of discussions
  - Regular discussions
  - Exam prep discussions
  - Extended-time discussions
  - We'll try to make recordings, but no promises
- Discussion schedule available on website
  - Discussions start next week (January 23)
- You can attend any discussion section you want (no need to enroll in a section)
  - A bit of extra credit available for attendance

Course Structure: Office Hours

- Join in-person or remotely to talk to staff about content, ask questions on assignments, or raise any concerns you have
- Schedule and queue available on website
  - Office hours start next week (January 23)

Course Structure: Exams

- Save the dates!
  - Midterm: Monday, March 6, 8–10pm PT
  - Final exam: Friday, May 12, 11:30am–2:30pm PT
- If you can't make it:
  - We'll offer remote exams at the listed time
  - We'll offer an in-person-only alternate exam right after the listed time
- More logistics closer to the exam

Resources

- Course website: https://inst.eecs.berkeley.edu/~cs188/sp23/
  - All resources (slides, notes, recordings, assignments, etc.) posted here
- Ed: Discussion forum replacing Piazza
- Staff email for private concerns: cs188@berkeley.edu
  - Making a private post on Ed is easier/faster
- Gradescope: Submit assignments here

Grading Structure

- Projects (25%)
  - Python programming assignments, autograded
  - You can optionally work with a partner
  - Reduced credit for submitting late, unless you have an extension
- Homework (20%)
  - Electronic homework: Autograded on Gradescope
  - Written homework: One question per week, graded by TAs on correctness
  - Submit individually (but feel free to discuss with others)
  - No late submissions, unless you have an extension
- Midterm (20%), Final Exam (35%)

Extensions and Accommodations

- We'll drop your lowest homework score
- You have 5 slip days to use across the projects
  - See course policies page for details on how they work
- If you ever need an extension, please request one!
  - We're here to support you, and we understand that life happens.
  - Extension form will be posted on the website

DSP

- Disabled Students' Program (DSP)
  - There's a variety of accommodations UC Berkeley can help us set up for you in this class
  - https://dsp.berkeley.edu/
- Are you facing barriers in school due to a disability?
  - Apply to DSP!
  - We maintain proper access controls on this information: Only instructors, course managers, head TAs, and logistics TAs can access any DSP-related info
- Our goal is to teach you the material in our course. The more accessible we can make it, the better.

Collaboration and Academic Dishonesty

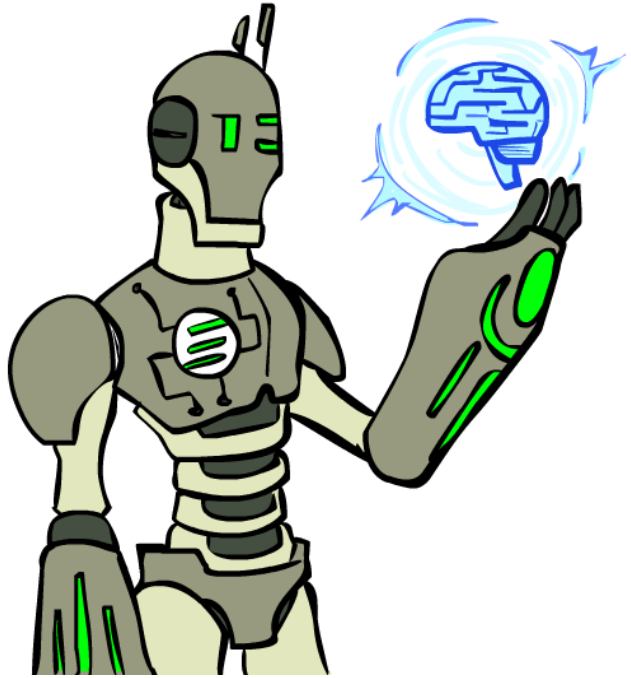
- We're here to help! There are plenty of staff and resources available for you
  - You can always talk to a staff member if you're feeling stressed or tempted to cheat
  - Collaboration on homework is okay, but please cite collaborators
  - Do not post solutions online or share with others!
- Academic dishonesty policies
  - Reported to Center of Student Conduct
  - Negative points on assignments, and/or F in the class

Stress Management and Mental Health

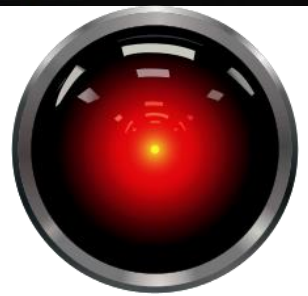
- **Your health is more important than this course**
- If you feel overwhelmed, there are options
  - Academically: Ask on Ed, talk to staff in office hours, set up a meeting with staff to make a plan for your success this semester
  - Non-academic:
    - Counselling and Psychological Services (CAPS) has multiple free, confidential services
      - Casual consultations: https://uhs.berkeley.edu/counseling/lets-talk
      - Crisis management: https://uhs.berkeley.edu/counseling/urgent
    - Check out UHS's resources: https://uhs.berkeley.edu/health-topics/mental-health

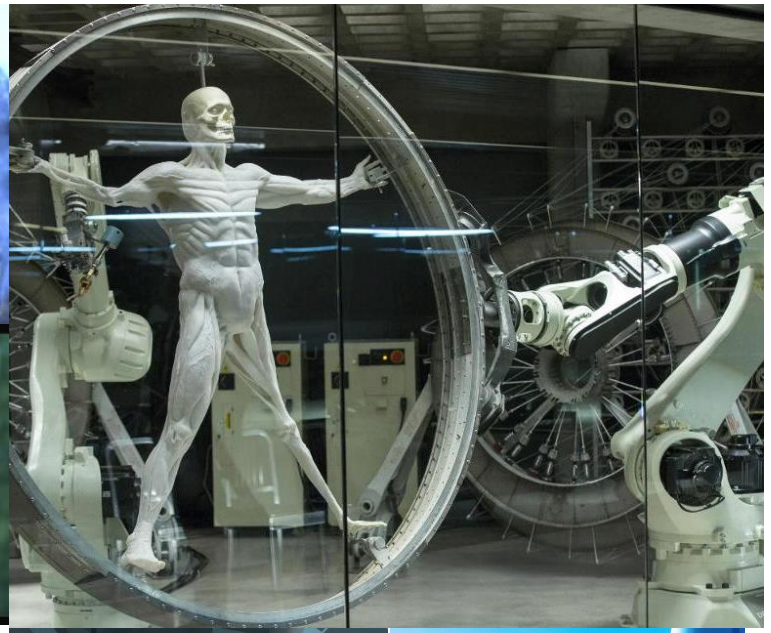
Second Half of Today: What is AI?

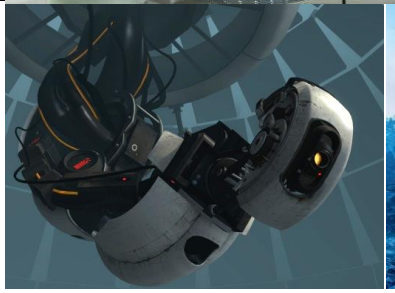
- What is artificial intelligence?
- What can AI do?
  - What should we worry about?
  - What can we do about those things?
  - What should we not worry about?
- What is this course?



Sci-Fi AI?



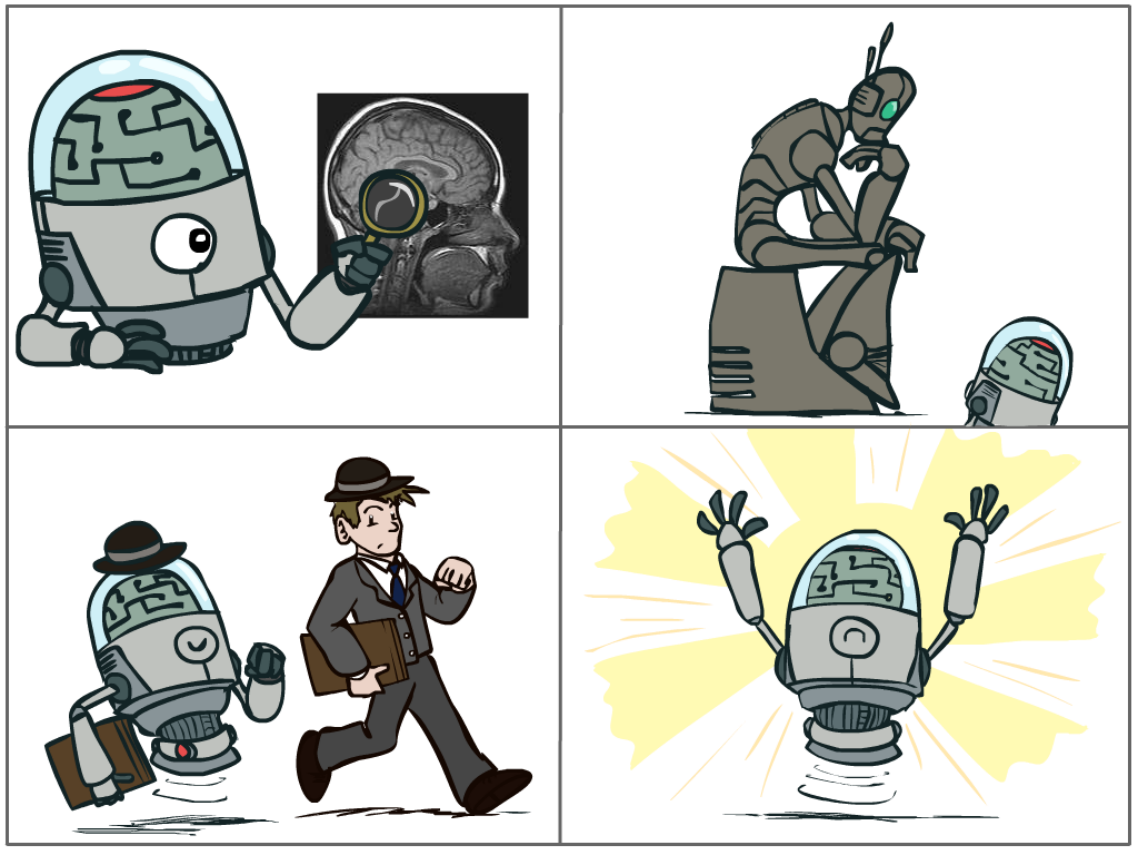




What is AI?

The science of making machines that:

Think like people



Think rationally

Act like people

Act rationally

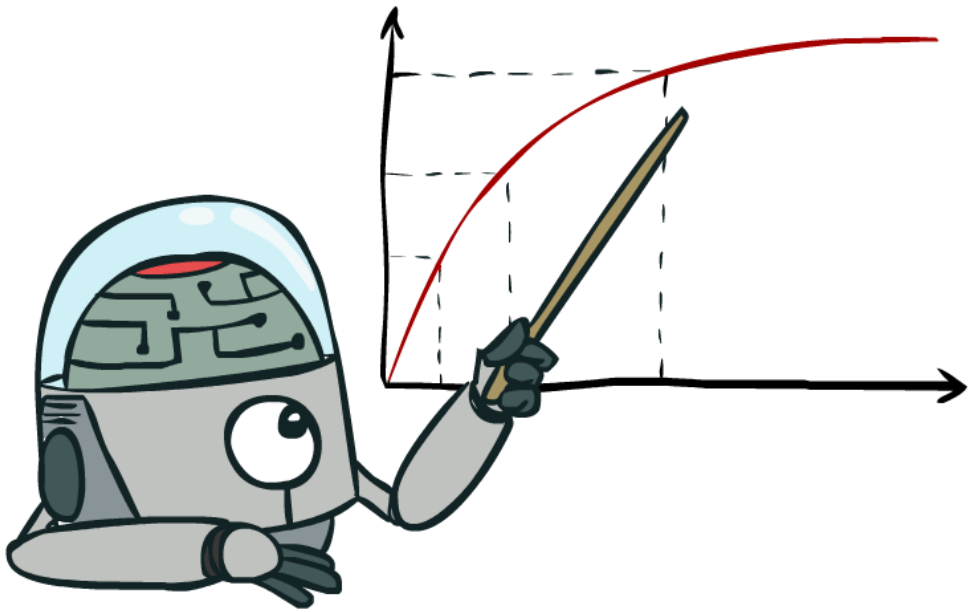
Rational Decisions

- We'll use the term **rational** 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

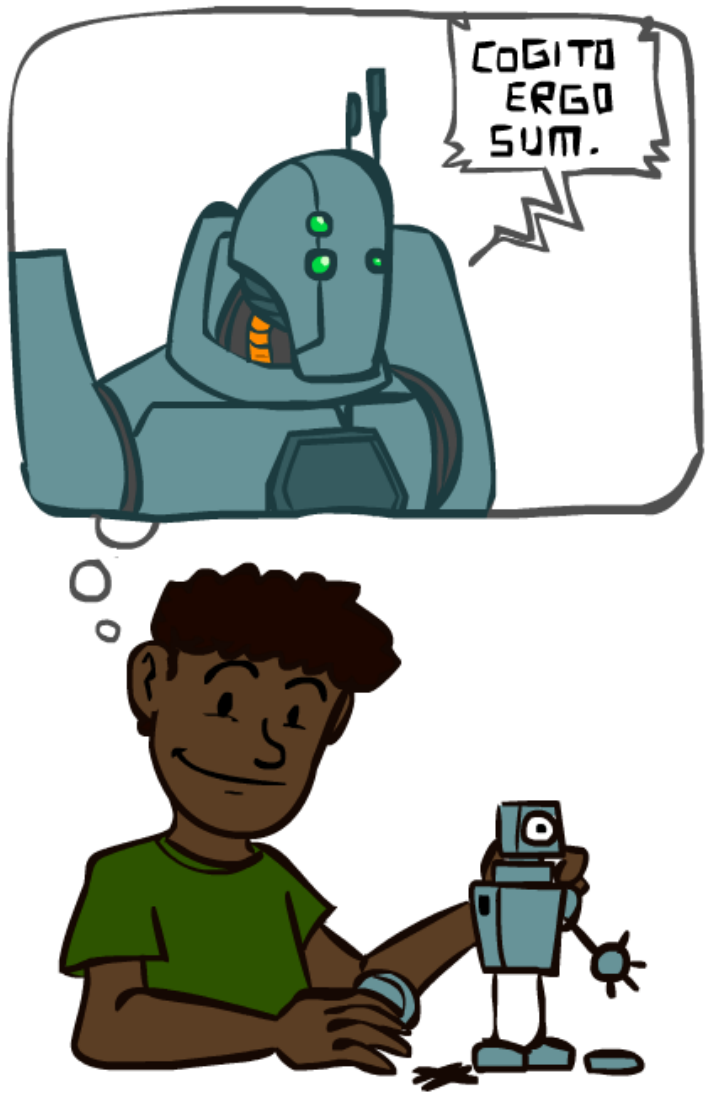
Maximize Your Expected Utility



What About the Brain?

- Brains (human minds) are very good at making rational decisions, but not perfect
- Brains aren't as modular as software, so hard to reverse engineer!
- "Brains are to intelligence as wings are to flight"
- Lessons learned from the brain: memory and simulation are key to decision making

A (Short) History of AI



A (Short) History of AI

- 1940-1950: Early days
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - 1950: Turing's “Computing Machinery and Intelligence”
- 1950—70: Excitement: Look, Ma, no hands!
  - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
  - 1956: Dartmouth meeting: “Artificial Intelligence” adopted
  - 1965: Robinson's complete algorithm for logical reasoning

A (Short) History of AI

- 1970—90: Knowledge-based approaches
  - 1969—79: Early development of knowledge-based systems
  - 1980—88: Expert systems industry booms
  - 1988—93: Expert systems industry busts: “AI Winter”
- 1990—: Statistical approaches
  - Resurgence of probability, focus on uncertainty
  - General increase in technical depth
  - Agents and learning systems… “AI Spring”?
  - 1996: Kasparov defeats Deep Blue at chess
  - 1997: Deep Blue defeats Kasparov at chess

“I could feel --- I could smell --- a new kind of intelligence across the table.” ~Kasparov

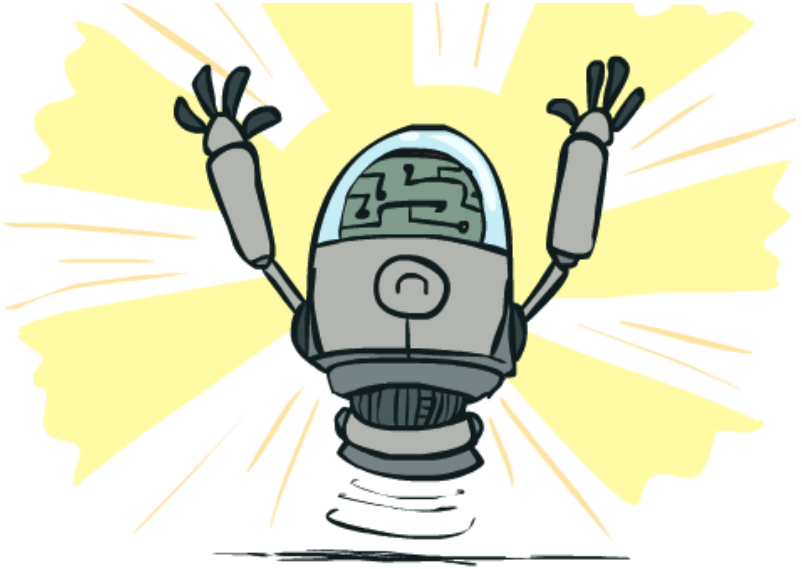
A (Short) History of AI

- 2000—: Where are we now?
  - Big data, big compute, neural networks
  - Some re-unification of sub-fields
  - AI used in many industries
  - Chess engines running on ordinary laptops can defeat the world's best chess players
  - 2011: IBM's Watson defeats Ken Jennings and Brad Rutter at Jeopardy!
  - 2016: Google's AlphaGo beats Lee Sedol at Go

What Can AI Do?

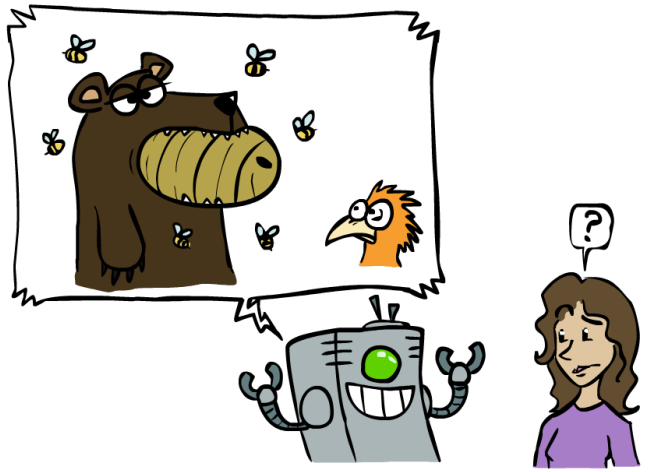
Quiz: Which of the following can be done at present?

- ✓ Play a decent game of Jeopardy?
- ✓ Win against any human at chess?
- ✓ Win against the best humans at Go?
- ✓ Play a decent game of tennis?
- ✓ Grab a particular cup and put it on a shelf?
- ✗ Unload any dishwasher in any home?
- ? Drive safely along the highway?
- ✗ 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?
- ✗ Perform a surgical operation?
- ✗ Unload a know dishwasher in collaboration with a person?
- ✓ Translate spoken Chinese into spoken English in real time?
- ✗ Write an intentionally funny story?



Unintentionally Funny Stories

- One day Joe Bear was hungry. He asked his friend Irving Bird where some honey was. Irving told him there was a beehive in the oak tree. Joe walked to the oak tree. He ate the beehive. The End.
- Henry Squirrel was thirsty. He walked over to the river bank where his good friend Bill Bird was sitting. Henry slipped and fell in the river. Gravity drowned. The End.
- Once upon a time there was a dishonest fox and a vain crow. One day the crow was sitting in his tree, holding a piece of cheese in his mouth. He noticed that he was holding the piece of cheese. He became hungry, and swallowed the cheese. The fox walked over to the crow. The End.



[Shank, Tale-Spin System, 1984]

AI in the News

Perhaps you've heard that there is an exciting new Barack Obama book that everyone's talking about! I'm not talking about *A Promised Land*, the 751-page memoir which Obama spent four years writing.

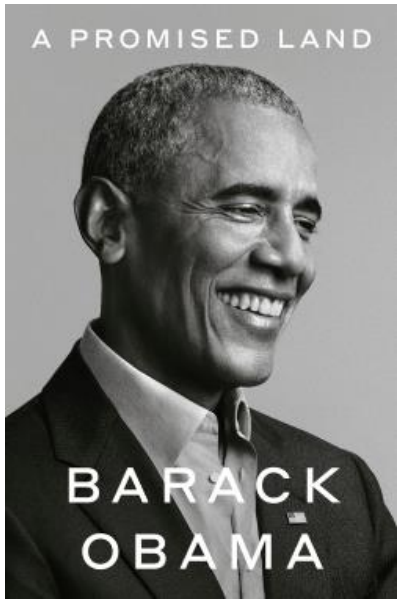
No, I'm talking about *Barack Obama Book*, a 61-page tome by an author named "University Press." Why is *Barack Obama Book* selling so well? Thanks to sponsored listings and canny search engine optimization, the book appears above Barack Obama's actual memoir if you search Amazon for—you guessed it—"barack obama book."

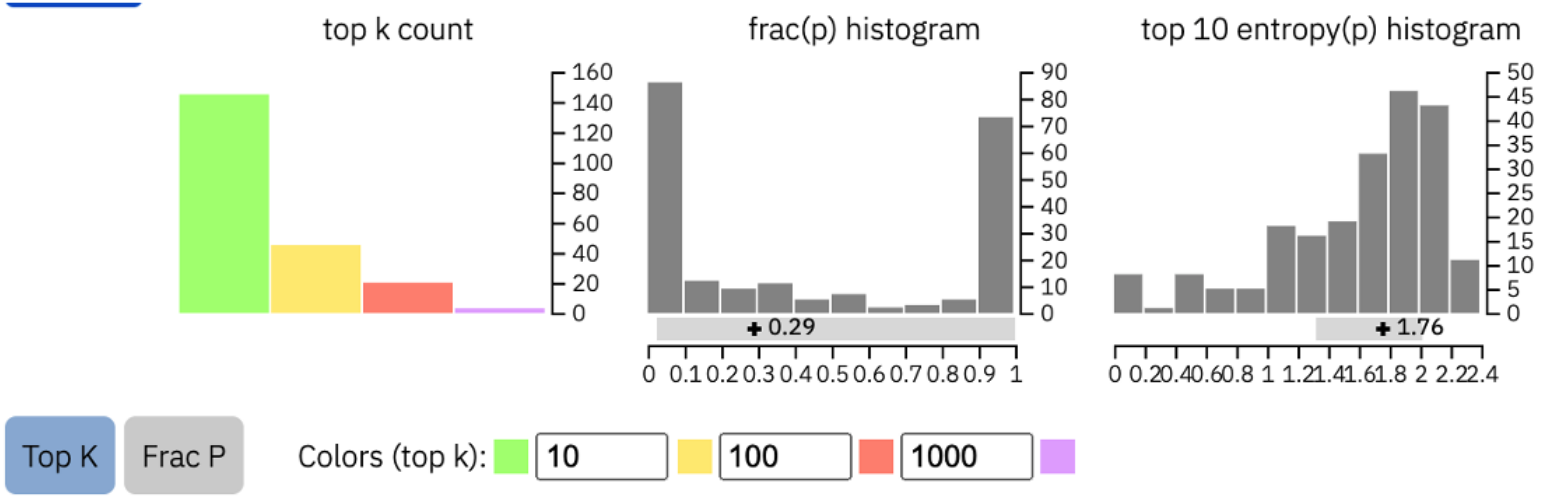
What is Barack Obama Book? It's not a book, exactly. It's an SEO ploy by a shadowy company that has scores of $2.99 knockoffs ready to be downloaded, from quickie biographies of au courant figures like Obama, Harris, and Dolly Parton, to obvious bestseller ripoffs like Caste: A Brief History and Ready Player 3, 2, 1: A Brief History (?).

I don't think Barack Obama Book was written by a human being, but I do think the A.I. that excreted it made some decent points about Barack Obama.

https://slate.com/culture/2020/11/what-is-barack-obama-book-university-press-amazon.html

AI in the News

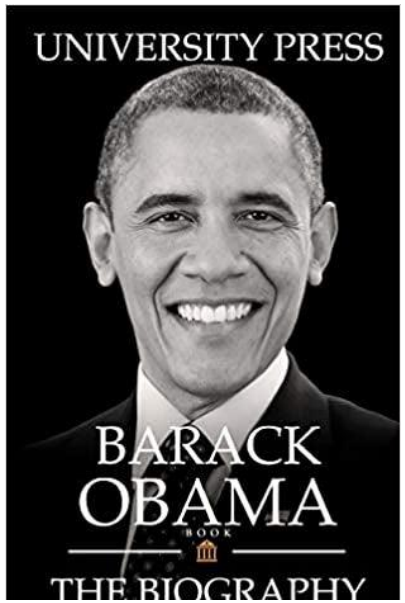


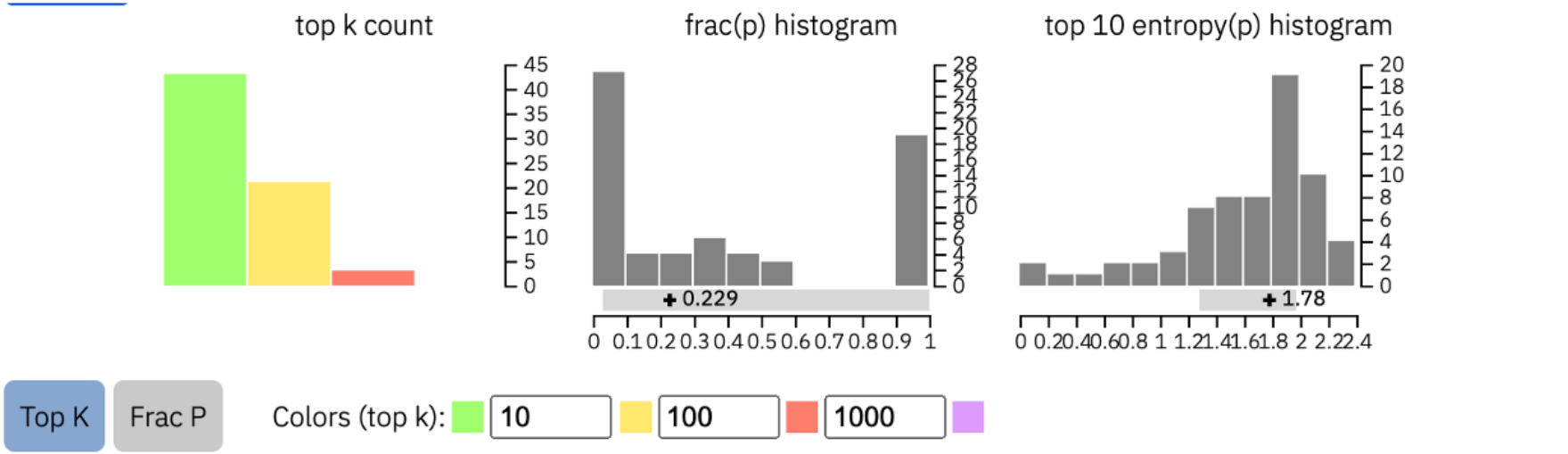


Based on what I'd heard, I decided we had enough information to begin developing options for an attack on the compound. While the CIA team continued to work on identifying the Pacer, I asked Tom Donlian and John Brennan to explore what a raid would look like. The need for secrecy added to the challenge; if even the slightest hint of our lead on bin Laden leaked, we knew our opportunity would be lost. As a result, only a handful of people across the entire federal government were read into the planning phase of the operation. We had one other constraint: Whatever option we chose could not involve the Pakistanis. Although Pakistan's government cooperated with us on a host of counterterrorism operations and provided a vital supply path for our forces in Afghanistan, it was an open secret that certain elements inside the country's military, and especially its intelligence services, maintained links to the Taliban and perhaps even to Al-Qaeda, sometimes using them as strategic assets to ensure that the Afghan government remained weak and unable to align itself with Pakistan's number one rival, India.

https://slate.com/culture/2020/11/what-is-barack-obama-book-university-press-amazon.html

AI in the News





https://slate.com/culture/2020/11/what-is-barack-obama-book-university-press-amazon.html

AI in the News

Elon Musk
@elonmusk

Tesla Full Self-Driving Beta is now available to anyone in North America who requests it from the car screen, assuming you have bought this option.

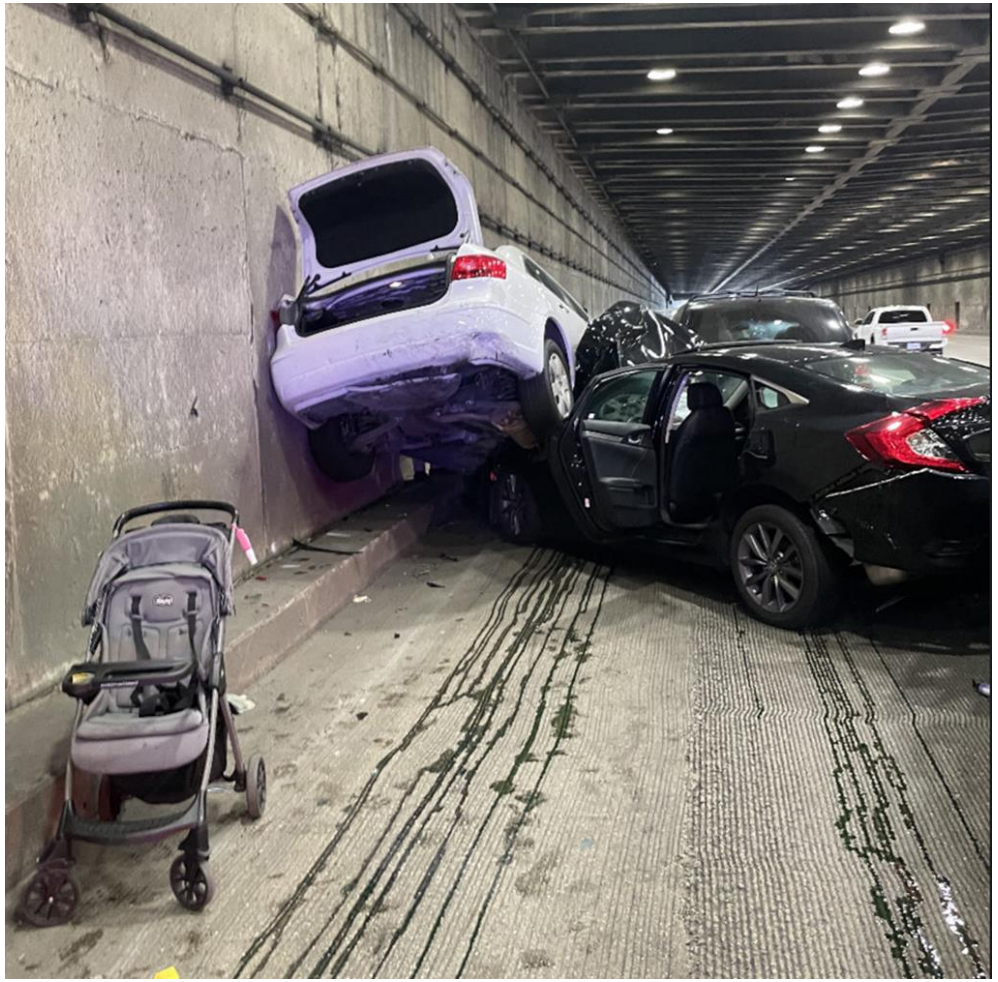
Congrats to Tesla Autopilot/AI team on achieving a major milestone!

11:34 PM · Nov 23, 2022

12.9K Retweets **2,651** Quote Tweets **174.1K** Likes

AI in the News

Highway surveillance footage from November 24 shows a Tesla Model S vehicle changing lanes and then abruptly braking in the far-left lane of the San Francisco Bay Bridge, resulting in an eight-vehicle crash.



As traditional car manufacturers enter the electric vehicle market, Tesla is increasingly under pressure to differentiate itself. Last year, Musk said that “Full Self-Driving” was an “essential” feature for Tesla to develop, going as far as saying, “It’s really the difference between Tesla being worth a lot of money or worth basically zero.”

https://theintercept.com/2023/01/10/tesla-crash-footage-autopilot/

Course Topics

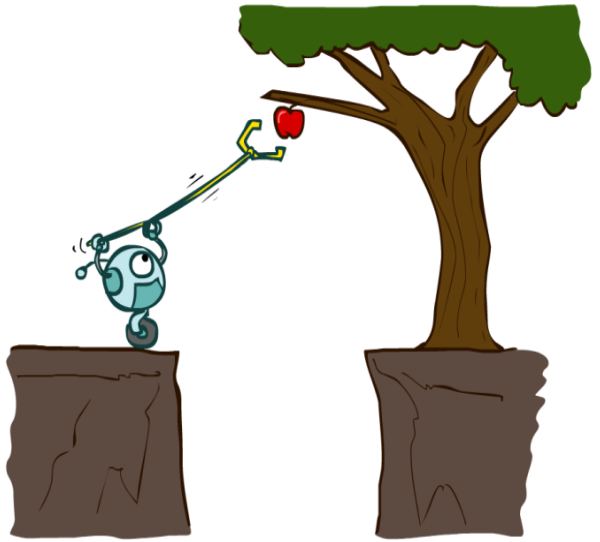
- Part 1: Intelligence from Computation
  - Fast search/planning
  - Constraint satisfaction (e.g. scheduling)
  - Adversarial and uncertain search (e.g. routing, navigation)
- Part 2: Intelligence from Data
  - Probabilistic inference with Bayes' nets (e.g. robot localization)
  - Decision theory
  - Supervised machine learning (e.g. spam detection)
- Throughout: Applications
  - Natural language, vision, robotics, games, etc.

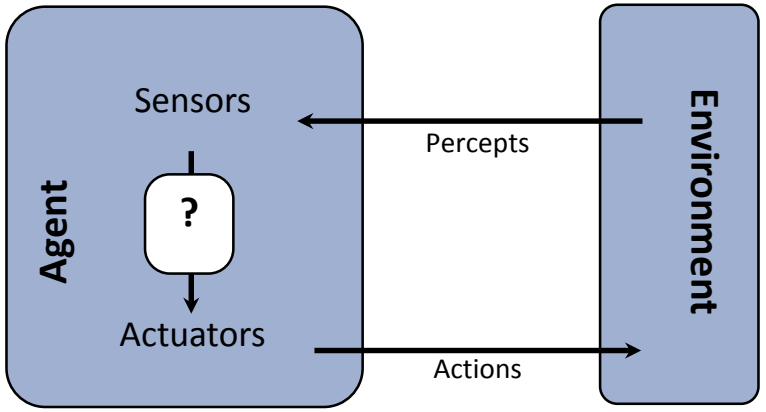
Should I take CS 188?

- Yes, if you want to know how to design rational agents!
  - CS 188 gives you extra mathematical maturity
  - CS 188 gives you a survey of other non-CS fields that interact with AI (e.g. robotics, cognitive science, economics)
- Disclaimer: If you're interested in making yourself more competitive for AI jobs, CS 189 and CS 182 are better fits.
  - The last few CS 188 lectures (neural networks) are used by many modern state-of-the-art systems. CS 189 and CS 182 cover these in more depth

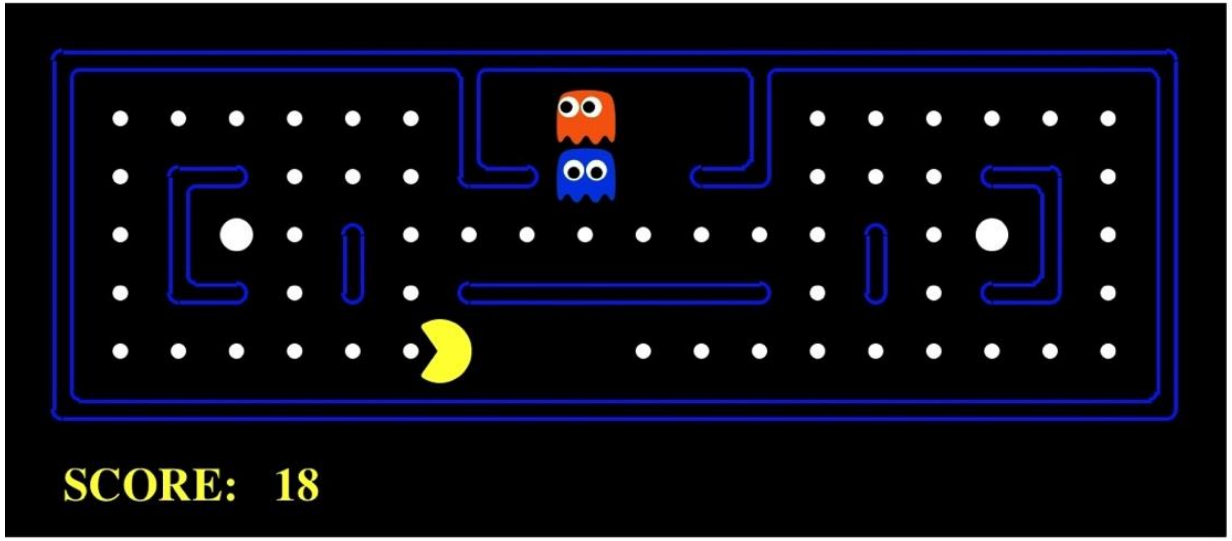
Designing Rational Agents

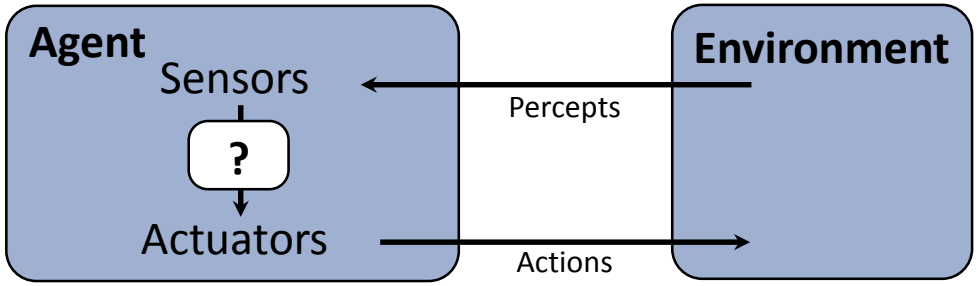
- An **agent** is an entity that perceives and acts.
- A **rational agent** selects actions that maximize its (expected) **utility**.
- Characteristics of the **percepts**, **environment**, and **action space** dictate techniques for selecting rational actions
- This course is about:
  - General AI techniques for a variety of problem types
  - Learning to recognize when and how a new problem can be solved with an existing technique





Pac-Man as an Agent





Pac-Man is a registered trademark of Namco-Bandai Games, used here for educational purposes