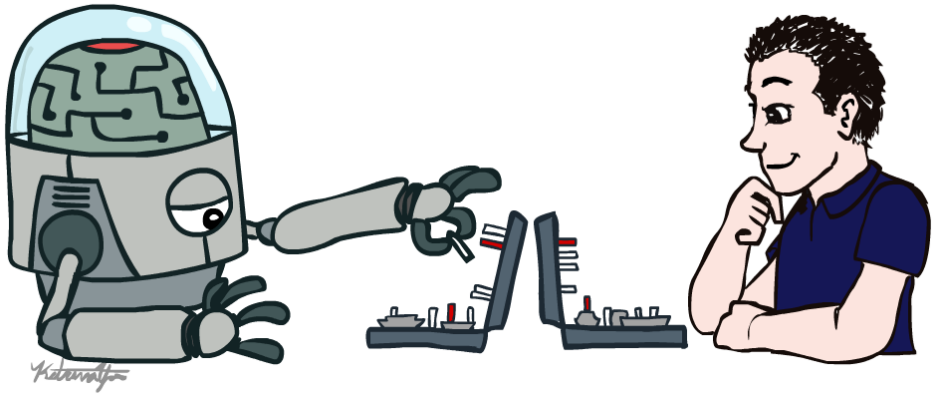
COMS W4701: Artificial Intelligence

Lecture 1: Course Intro, Background of AI



Instructor: Tony Dear

*Lecture materials derived from UC Berkeley's AI course at ai.berkeley.edu

Today

- (Obligatory) course logistics
- What is AI, historical and modern?
- What is covered in this course?

Course Staff

- Instructor: Tony Dear <tony.dear@columbia.edu>
  - Office hours in 618 CEPSR, M 4-6pm and W 2-4pm

- Instructional assistants:
  - Bryan Li <b.li@columbia.edu> (head TA)
  - Jaewan Bahk <jb3621@columbia.edu>
  - Alex Calderwood <adc2181@columbia.edu>
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  - Animesh Sharma <aas2325@columbia.edu>
  - Claudia Shi <js5334@columbia.edu>
  - Vivek Subramanian <vs2575@columbia.edu>

- Office hours TBD

Class Sessions

- Lecture sections
  - TTH 10:10am – 11:25am in 501 Schermerhorn
  - TTH 5:40pm – 6:55pm in 329 Pupin
- Recitation sections
  - Will be scheduled over the next week (maybe 2 per week)
  - Optional, will be led by TA
  - Practice with problem solving and reviewing concepts

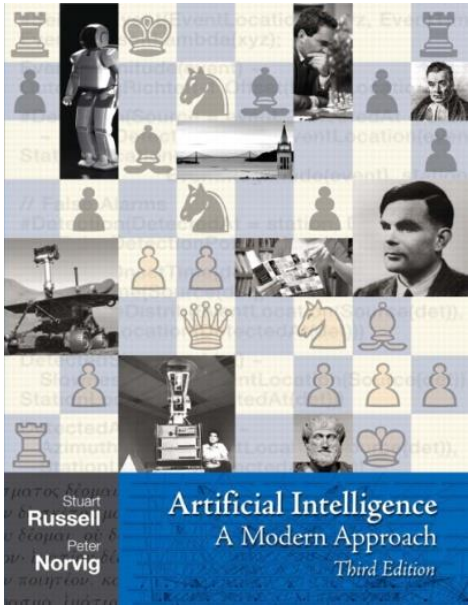
Online Resources

- Courseworks 2 / Canvas
  - Schedule and syllabus
  - Lecture materials (in Modules) and Assignments
  - Grades

- Piazza
  - Discussion forum for all questions related to the course (lectures, assignments, etc.)
  - Students should try to help each other out whenever possible!
  - Only urgent or private logistical questions thru email

Preliminaries

- No required textbook
- Recommended: Russell and Norvig. *AI: A Modern Approach (3rd ed.)*



- Prerequisites
  - Data structures (3134, 3137)
  - Discrete math (3203)
  - Probability and linear algebra
  - Some Python recommended (HW0)

Grading

Homework (HW0 + HW1-5)	50%
Midterm (~Oct 18)	20%
Final	25%
Participation	5%

- **Late and early** submission policy
- Participation in lecture and online
- Grading: max(fixed, curved) scales

Academic Integrity and Collaboration

- Collaboration encouraged!
  - In class (polling), Piazza, and on assignments
  - Discuss assignments, but **submit your own writeups and code**
  - **Acknowledge all collaborators**

- Any suspicion of passing off other work, either that of your peers or other (online) sources, as your own will be investigated immediately.

Announcements for Today

- HW 0 is out on Canvas, due next Thursday
- Contact Tony with email if not on Piazza
- Tony will be holding OH tomorrow (W 2-4pm)
- Enrollment and wait list

- Pieter Abbeel (UC Berkeley) will be visiting next week

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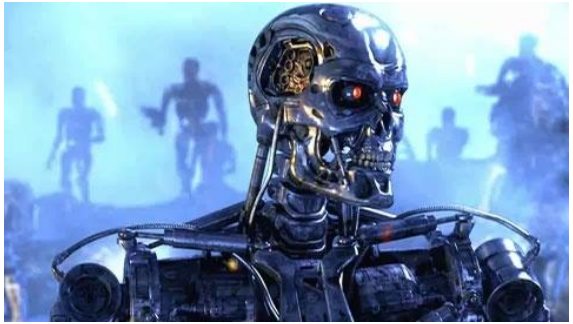
Deep Learning to Learn

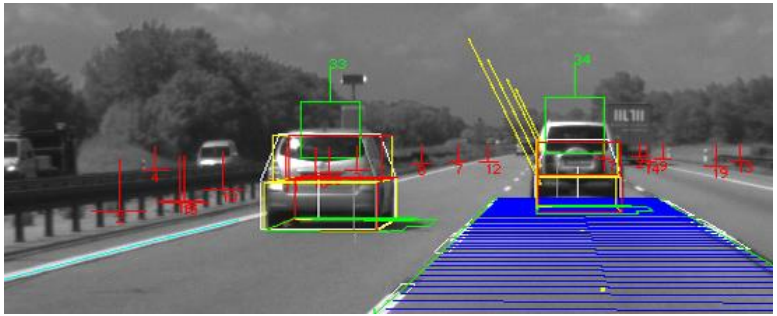
SEPT. 10, 2018 (MONDAY)
11:30AM–12:30PM
DAVIS AUDITORIUM
(412 CEPSR)

What comes to your mind when you think "artificial intelligence"?

Sci-Fi AI?



AI in Society Today



Defining “Artificial Intelligence”

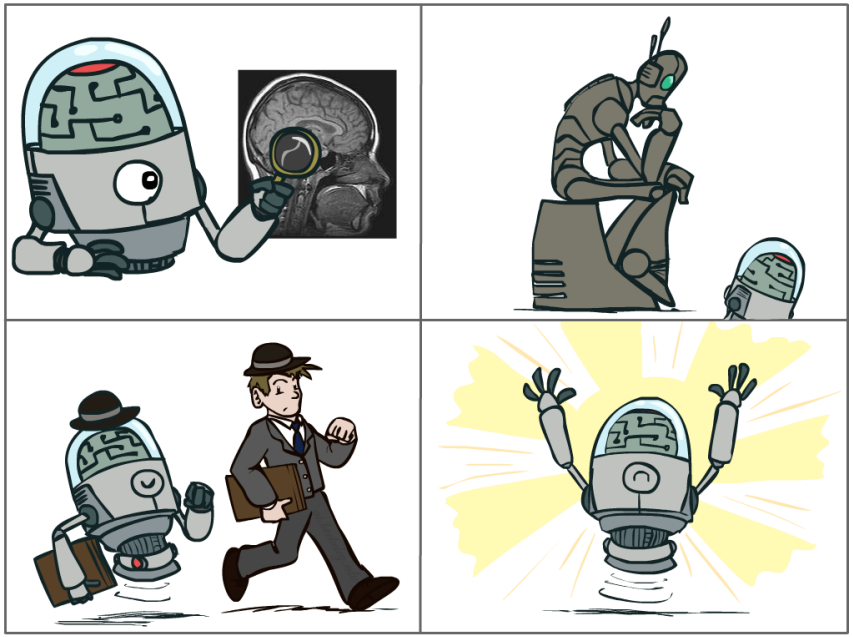
- Intelligence: *Mental quality that consists of the abilities to **learn** from experience, **adapt** to new situations, understand and handle **abstract** concepts, and use knowledge to **manipulate** one’s environment.* (Encyclopedia Brittanica)

- Can we distill this down?

What is AI?

The science of making machines that:

Think like people



Think rationally

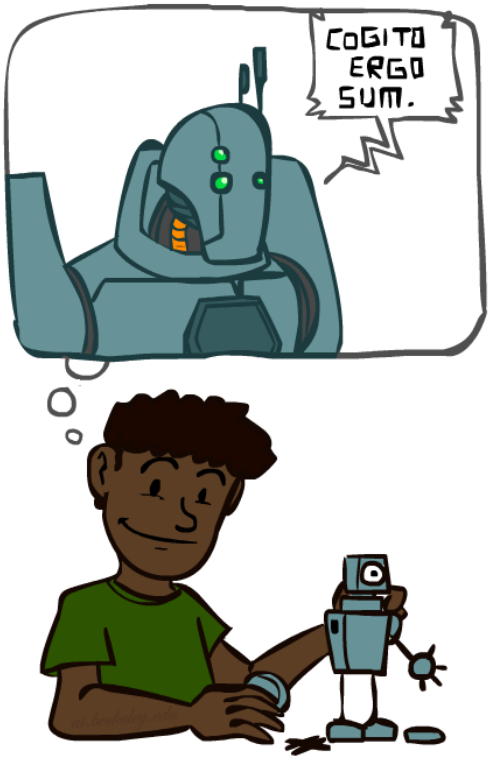
Act like people

Act rationally

Acting Rationally

- An *agent* interacts with its environment through *perception* and *action* to achieve a pre-defined goal.
- A *rational agent* **maximizes the utility** of the goal outcomes.
- Focus on optimal **behavior**, not optimal reasoning.

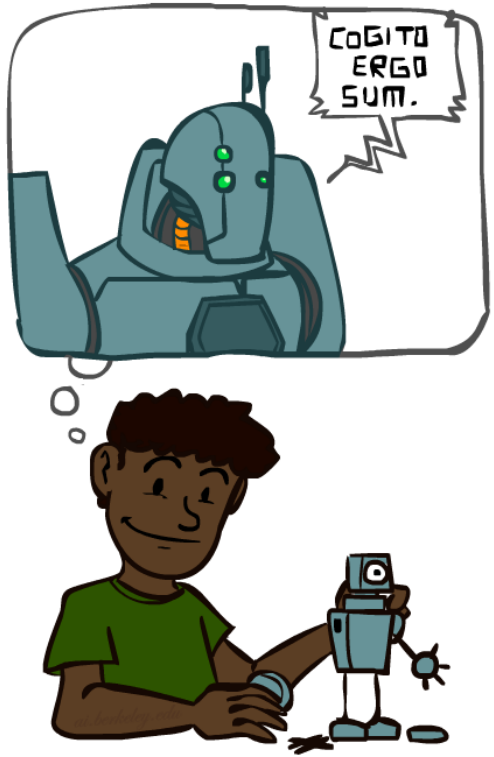
A (Short) History of AI



Demo: HISTORY – MT1950.wmv

A (Short) History of AI

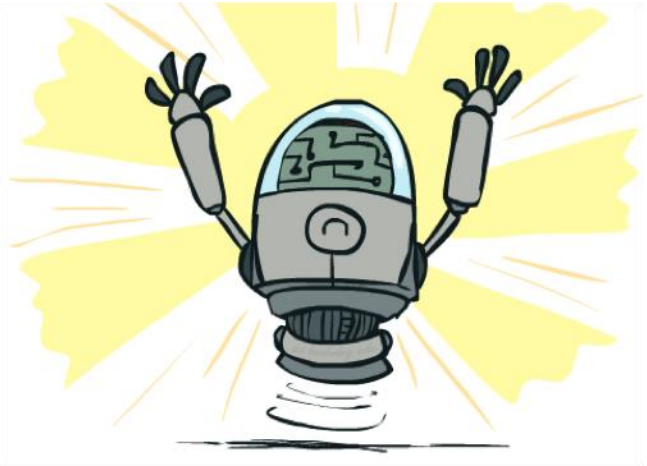
- 1940-1950: Early days
  - 1943: McCulloch & Pitts: **Boolean circuit model** of brain
  - 1950: Turing's "Computing Machinery and Intelligence"
- 1950—70: Excitement: Look, Ma, no hands!
  - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
  - 1956: **Dartmouth meeting**: "Artificial Intelligence" adopted
  - 1965: Robinson's complete algorithm for logical reasoning
- 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"?
- 2000—: Where are we now?



What Can AI Do?

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

- ✓ Play a decent game of table tennis?
- ✓ Play a decent game of Jeopardy?
- ✓ Drive safely along a curving mountain road?
- ? Drive safely along Broadway? (Uber…)
- ✓ Buy a week's worth of groceries on the web?
- ✗ Buy a week's worth of groceries at Whole Foods?
- ? 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?

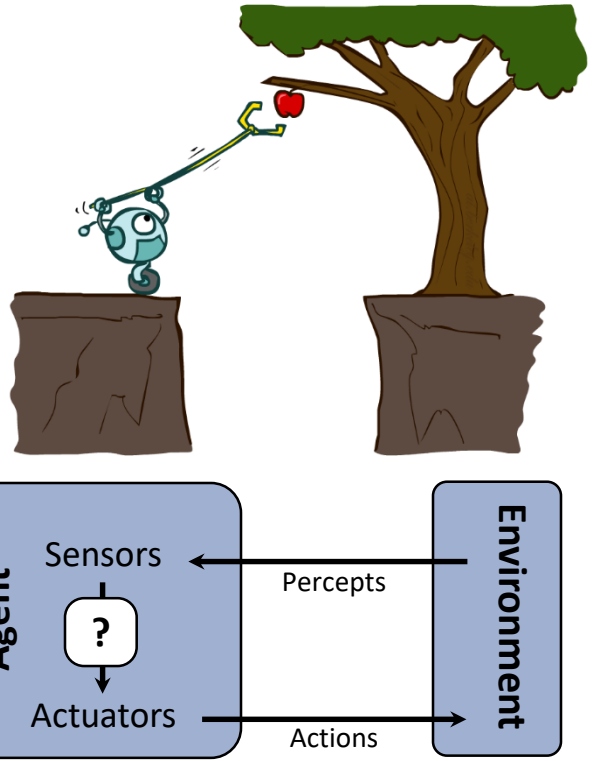


Modern Applications

- Natural language processing: speech technologies, conversations, machine translation, web search, text classification
- Vision and perception: Recognition, segmentation, classification
- Robotics: Integration with mech design, physical environments, planning, control, interactions with humans
- Game playing (Chess, Jeopardy, Go) and decision making—scheduling, routing, spam filters, fraud detection, product recommendations

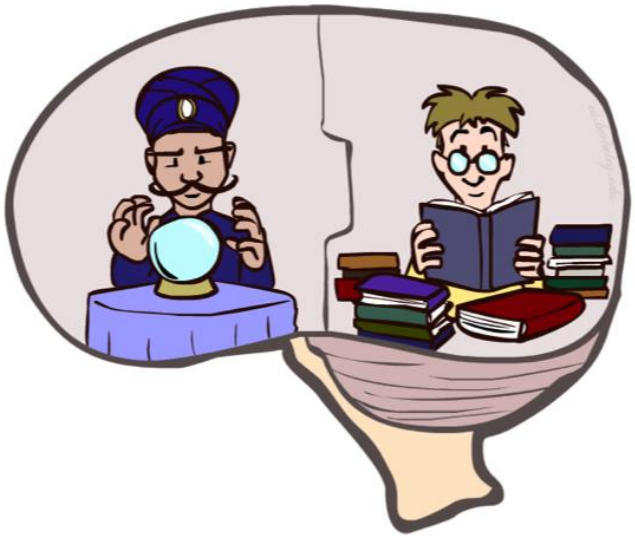
Designing Rational Agents

- 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 problems
  - Learning to recognize when and how a new problem can be solved with an existing technique



Course Outline

- Part I: Making Decisions
  - Fast search / planning
  - Constraint satisfaction
  - Adversarial and uncertain search
- Part II: Reasoning under Uncertainty
  - Bayes' nets
  - Decision theory
  - Machine learning
- Throughout: Applications
  - Natural language, vision, robotics, games, …



What is one thing you want to take away from this course?