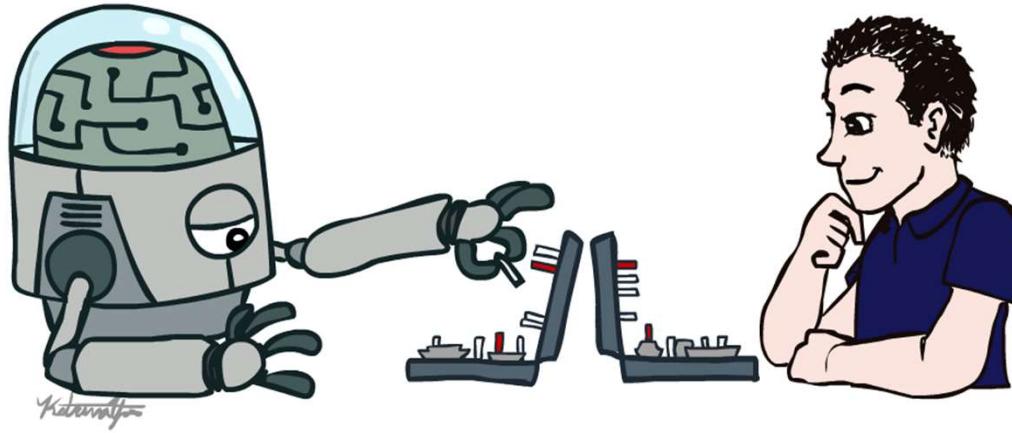


Artificial Intelligence

Introduction



Instructors: Fatemeh Mansoori

University of Isfahan

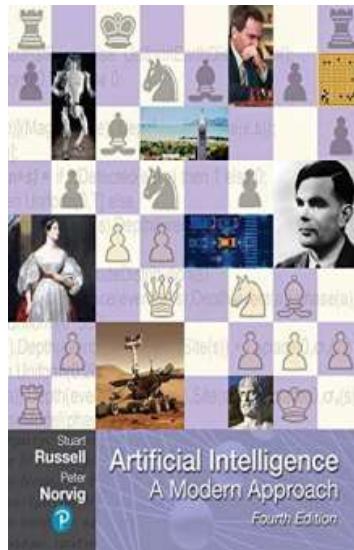
[These slides are based on slides created by Dan Klein and Pieter Abbeel at UC Berkeley. All materials available at <http://ai.berkeley.edu>.]

Course Information

- Communication:
 - Announcements on webpage <http://lms.ui.ac.ir/>
 - Questions?
 - Staff email: f.mansoori@mcs.ui.ac.ir
- Work and Grading:
 - assignments and project: 30%
 - Midterm 35-30%
 - Final 35-30%
- TA
 - بهزاد کیماسی
 - امیرحسین رنجبر

Textbook

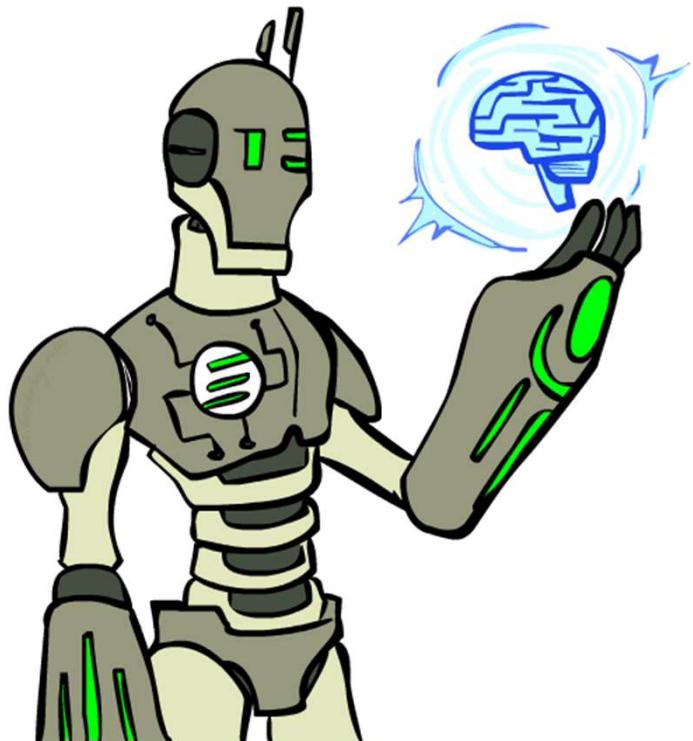
- Russell & Norvig, AI: A Modern Approach, 3rd Ed.



- Warning: Not a course textbook, so our presentation does not necessarily follow the presentation in the book.
- Course is based on the AI at Berkley you can access this course via :
<https://inst.eecs.berkeley.edu/~cs188/fa23/>

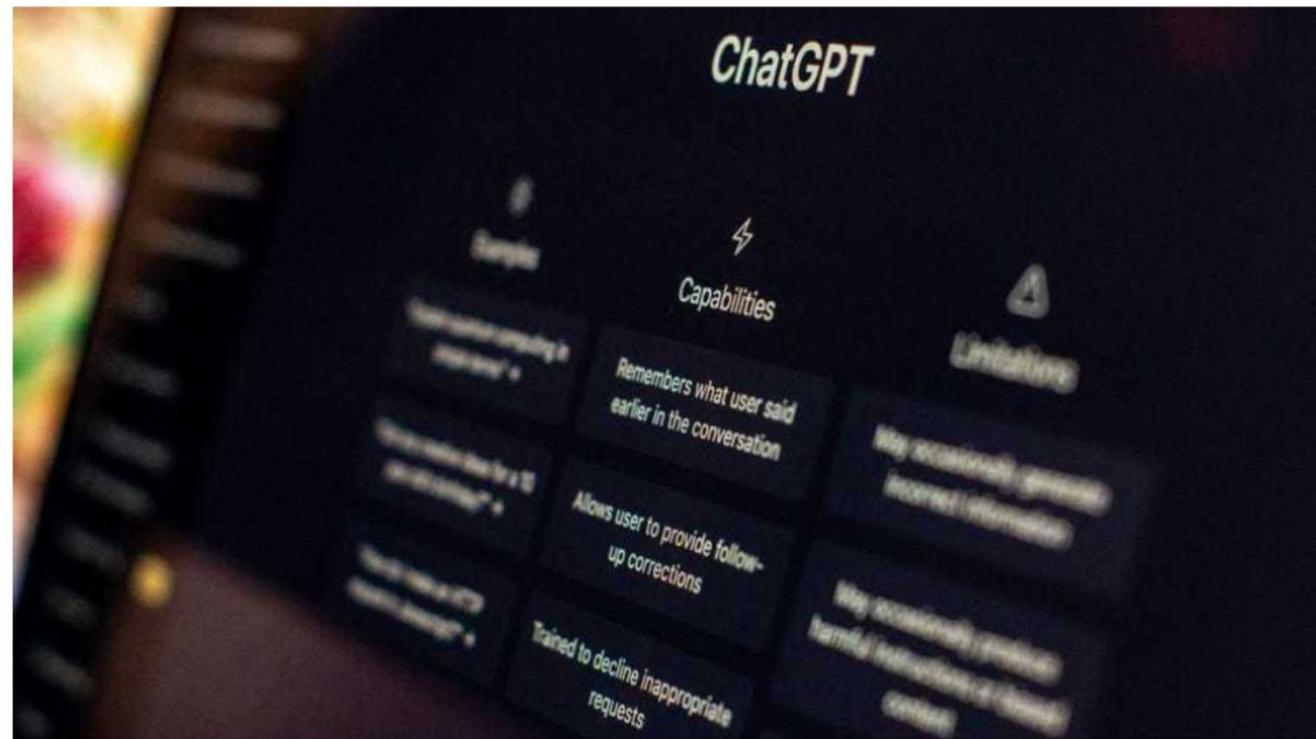
Today

- What is artificial intelligence?
- What can AI do?
- What is this course?



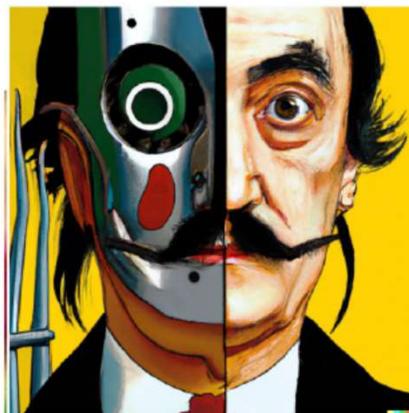
AI is having real-world impact

- Public imagination
 - Text assistants



AI is having real-world impact

- Public imagination
 - Text assistants
 - Image generation



vibrant portrait painting of Salvador Dalí with a robotic half face



a shiba inu wearing a beret and black turtleneck



a close up of a handpalm with leaves growing from it



an espresso machine that makes coffee from human souls, artstation



panda mad scientist mixing sparkling chemicals, artstation



a corgi's head depicted as an explosion of a nebula

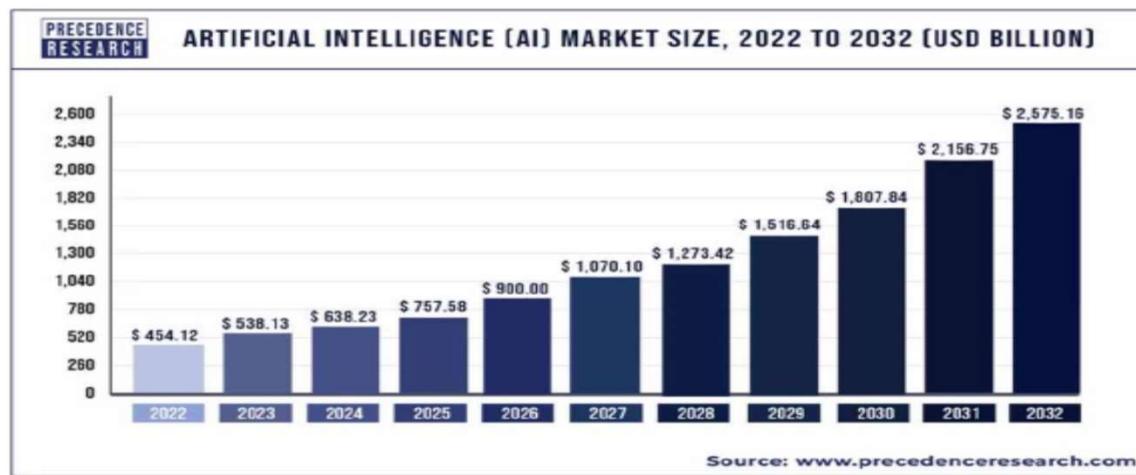
Where are these images?



AI is having real-world impact

- Public imagination
 - Economy
 - 454 billion USD globally

The global artificial intelligence (AI) market size was valued at USD 454.12 billion in 2022 and is expected to hit around USD 2,575.16 billion by 2032, progressing with a CAGR of 19% from 2023 to 2032. The North America artificial intelligence market was valued at USD 167.30 billion in 2022.



<https://www.precedenceresearch.com/artificial-intelligence-market>

AI is having real-world impact

- Politics



AI is having real-world impact



AI is having real-world impact



AI is having real-world impact



AI is having real-world impact

- Public imagination
 - law

Aug. 18, 2023, 12:18 PM; Updated: Aug. 18, 2023, 12:48 PM

AI-Generated Art Lacks Copyright Protection, D.C. Court Says (1)



Riddhi Setty
Reporter



Isaiah Poritz
Legal Reporter



Bloomberg Law, 2023

AI is having real-world impact

- Public imagination
 - Labor

Finance & economics | Free exchange

New research shows the robots are coming for jobs—but stealthily

Look beneath the aggregate economic numbers, and change is afoot

The Economist, 2021

The Optimist's Guide to Artificial Intelligence and Work

The focus of much discussion is on how it will replace jobs, but nothing is inevitable.

New York Times, 2023

The human labor behind AI chatbots and other smart tools

Data labeling is an important step in developing artificial intelligence but also exposes the people doing the work to harmful content.

MarketWatch, 2023

AI is having real-world impact

■ Sciences

nature
BIOTECH

AlphaFold Developers Win \$3-Million Breakthrough Prize in Life Sciences

DeepMind's system for predicting the 3D structure of proteins is among five recipients of science's most lucrative awards

By Zeeya Merali, Nature magazine on September 22, 2022

Nature, 2022

AI is having real-world impact

- Education

BREAKING

ChatGPT In Schools: Here's Where It's Banned—And How It Could Potentially Help Students

Arianna Johnson Forbes Staff

I cover the latest trends in science, tech and healthcare.

Follow

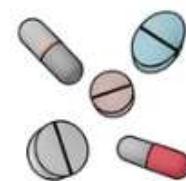
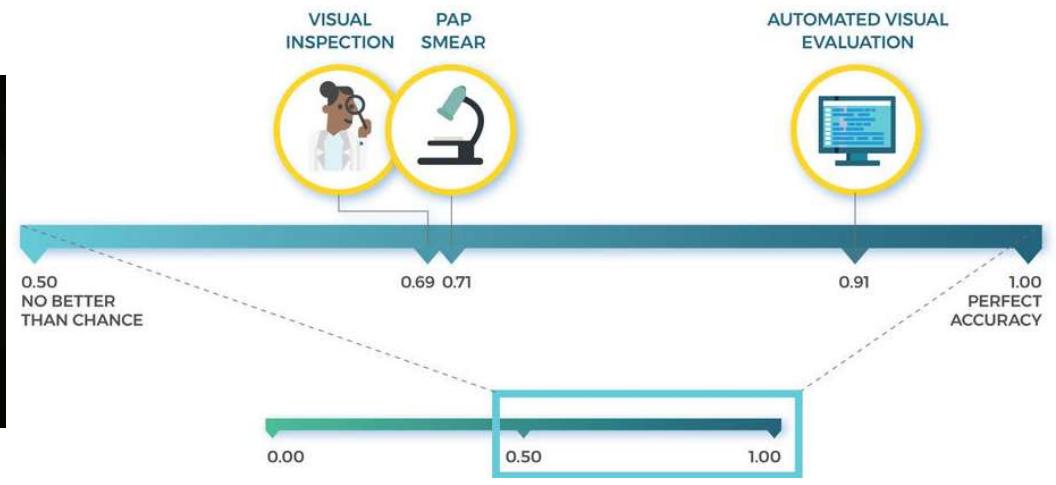
2

Jan 18, 2023, 02:31pm EST

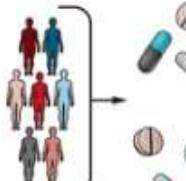
Forbes, 2023

AI is having real-world impact

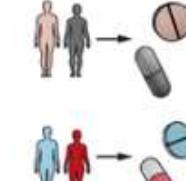
■ Health



Combination therapy design



Patient-therapy matching



AI is having real-world impact

- Military



AI is having real-world impact

- Home and everyday use

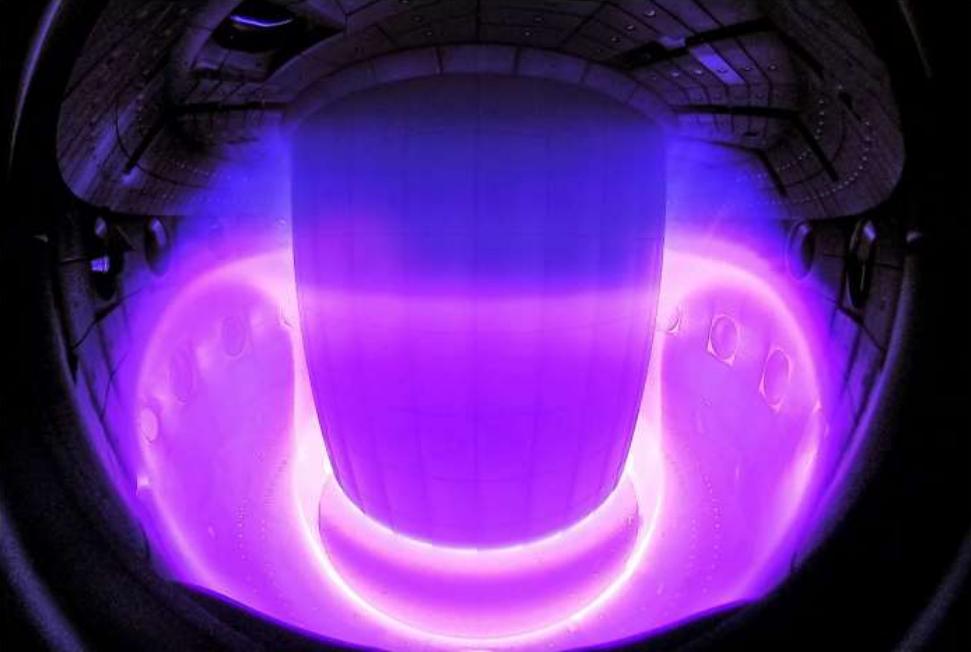


AI is having real-world impact

AMIT KATWALA SCIENCE FEB 16, 2022 11:08 AM

DeepMind Has Trained an AI to Control Nuclear Fusion

The Google-backed firm taught a reinforcement learning algorithm to control the fiery plasma inside a tokamak nuclear fusion reactor.



A photograph showing the interior of a tokamak reactor. The central plasma is a bright, glowing purple and pink, surrounded by a darker, blue-tinted region. The reactor's metallic walls and structural supports are visible around the perimeter. The image captures the complex magnetic field lines and the intense heat of the plasma.

PHOTOGRAPH: CURDIN WÜTHRICH, SPC/EPFL

Wired, 2022

Self-driving Cars

HOW UBER'S FIRST SELF-DRIVING CAR WORKS



SOURCE: Uber

BUSINESS INSIDER

Sentiment Analysis



“The food was very good, but it took over half an hour to be seated, ... and the service was terrible. The room was very noisy and cold wind blew in from a curtain next to our table. Desserts were very good, but because of [the] poor service, I’m not sure we’ll ever go back!”

Marketing

COLLABORATIVE FILTERING

Read by both users



Read by her,
recommended to him!

CONTENT-BASED FILTERING



Similar articles

Recommended
to user



Ok, but what does AI *do*???

What is AI?

We called ourselves **Homo sapiens**-man the wise—because our intelligence is so important to us

AI is :

concerned with not just understanding but also *building* intelligent entities

Historically, researchers have pursued several different versions of AI :

- In terms of fidelity to *human* performance
- prefer an abstract, formal definition of intelligence called **rationality**-loosely speaking, doing the “right thing.”
- some consider intelligence to be a property of internal *thought processes* and *reasoning*
- focus on intelligent *behavior*, an external characterization

What is AI?

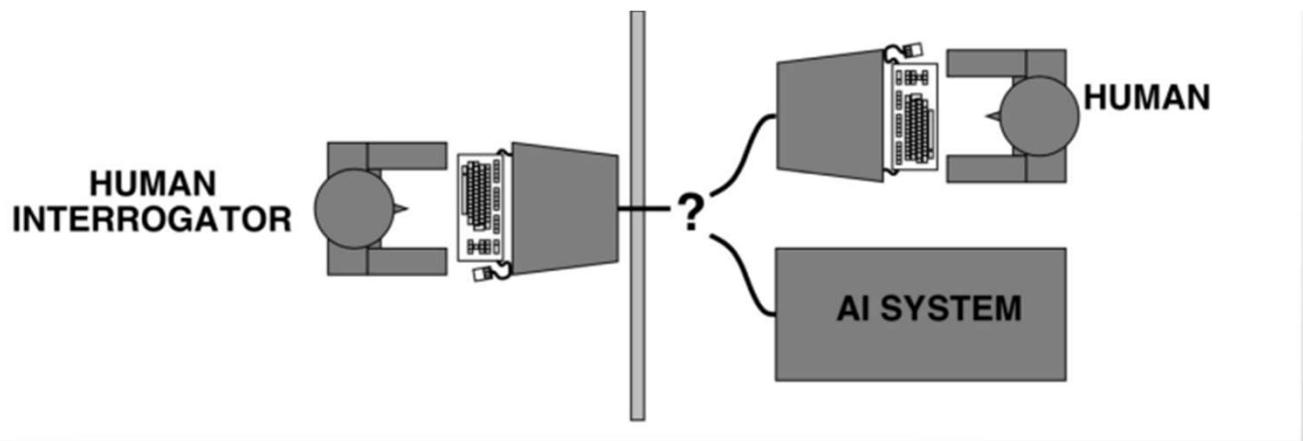
The science of making machines that:

Thinking humanity

- program thinks like a human, we must know how humans think
 - **introspection**—trying to catch our own thoughts as they go by
 - **psychological experiments**—observing a person in action
 - **brain imaging**—observing the brain in action.
- Once we have a sufficiently precise theory of the mind, it becomes possible to express the theory as a computer program
 - For e.g: Allen Newell and Herbert Simon, who developed GPS (General Problem Solver)
 - were not content merely to have their program solve problems correctly
 - concerned with comparing the sequence and timing of its reasoning steps to those of human subjects
- cognitive science brings together computer models from AI and experimental techniques from psychology to construct precise and testable theories of the human mind.

Acting humanity

- Turing (1950) :
 - Operational test for intelligent behavior :



- Turing Test is not reproducible or amenable to mathematical analysis

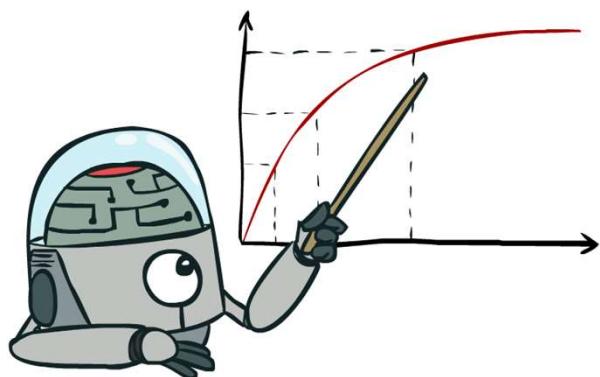
Thinking rationally

- Greek philosopher Aristotle was one of the first to attempt to codify “right thinking”
 - provided patterns for argument structures that always yielded correct conclusions when given correct premises
- Several Greek schools developed various forms of logic: notation and rules of derivation for thoughts;
 - Logicians in the 19th century developed a precise notation for statements about objects in the world and the relations among them
 - By 1965, programs could, in principle, solve *any* solvable problem described in logical notation
- Caveat: Not all intelligent behavior is mediated by logical deliberation

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**

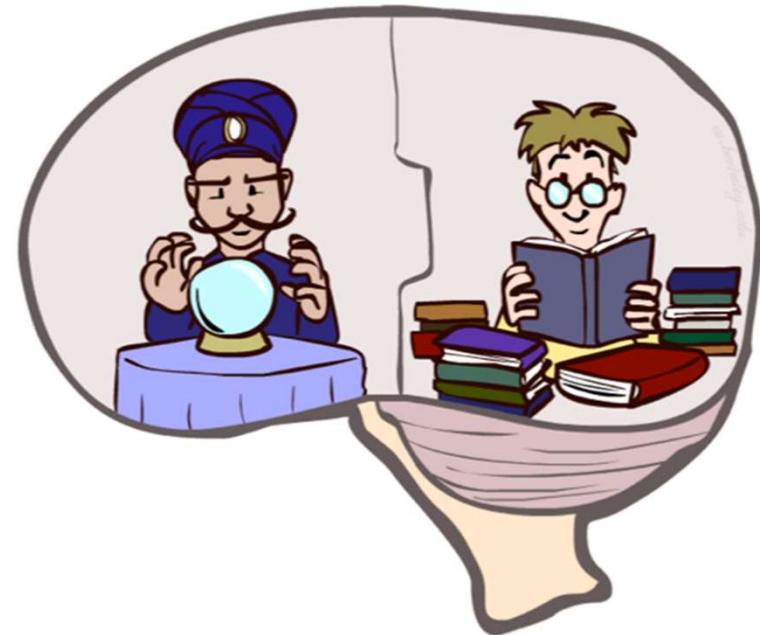


A better title for this course would be:
Computational Rationality

- Agent is something that act
 - All computer programs do something
 - Computer agents are expected to :
 - Operate autonomously
 - Perceive their environment
 - Adopt to change
 - Create and pursue goals
- Rational Agent:
 - Is one that acts so as to achieve the best outcome
 - When there is uncertainty, the best expected outcome

What About the Brain?

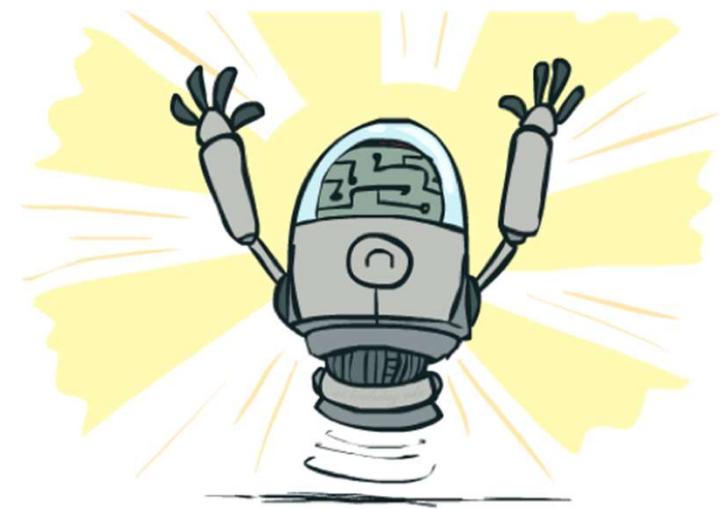
- Brains (human minds) are very good at making rational decisions, but not perfect
- Brains aren't as modular as software, so hard to reverse engineer!
- "Brains are to intelligence as wings are to flight"
- Lessons learned from the brain: memory and simulation are key to decision making



What Can AI Do?

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

- Win against any human at chess?
- Win against the best humans at Go?
- Play a decent game of tennis?
- Unload any dishwasher in any home?
- Drive safely along the highway?
- Drive safely along streets of San Francisco?
- 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?
- Translate spoken Chinese into spoken English in real time?
- Win an art competition?
- Write an intentionally funny story?
- Construct a building?







California just opened the floodgates for self-driving cars

After a state regulatory board ruling, San Francisco will have 24/7 robotaxis on its streets. A Washington Post analysis shows how it's a pivotal moment for the industry.

By [Trisha Thadani](#) and [Jeremy B. Merrill](#)

Updated August 10, 2023 at 10:06 p.m. EDT | Published August 10, 2023 at 9:15 p.m. EDT



write me a very, very short funny story

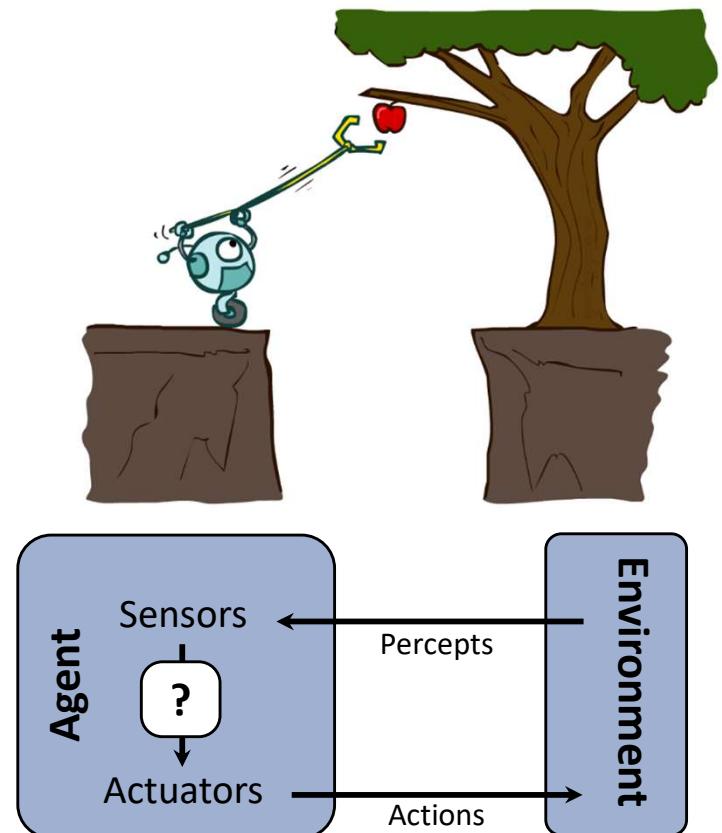


In a world where alarm clocks had minds of their own, Tom's clock decided it was tired of the daily grind. One morning, instead of blaring its usual wake-up call, it played "Eye of the Tiger" at full volume while flashing disco lights. Startled and thoroughly entertained, Tom couldn't help but dance his way out of bed, realizing he had just been outwitted by an alarm clock with a flair for the dramatic. From that day on, waking up became a daily dance-off between man and machine, with Tom perfecting his morning moves and the clock unveiling new surprises, turning the bedroom into a groovy battleground at dawn.

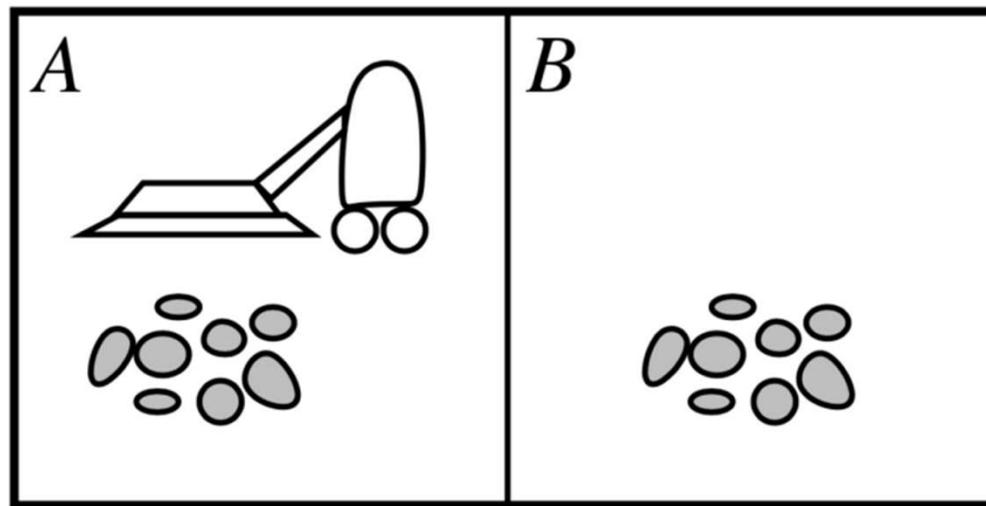


Designing Rational Agents

- 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



Vacuum-cleaner world



Percepts: location and contents, e.g., [A, Dirty]

Actions: *Left*, *Right*, *Suck*, *NoOp*

A Vacuum-cleaner agent

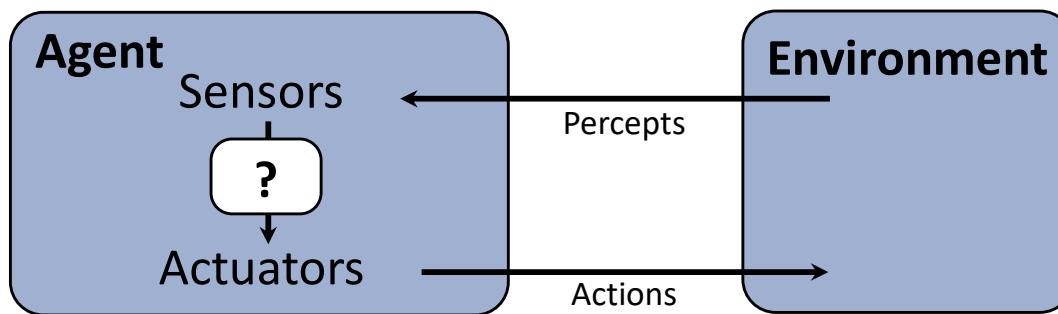
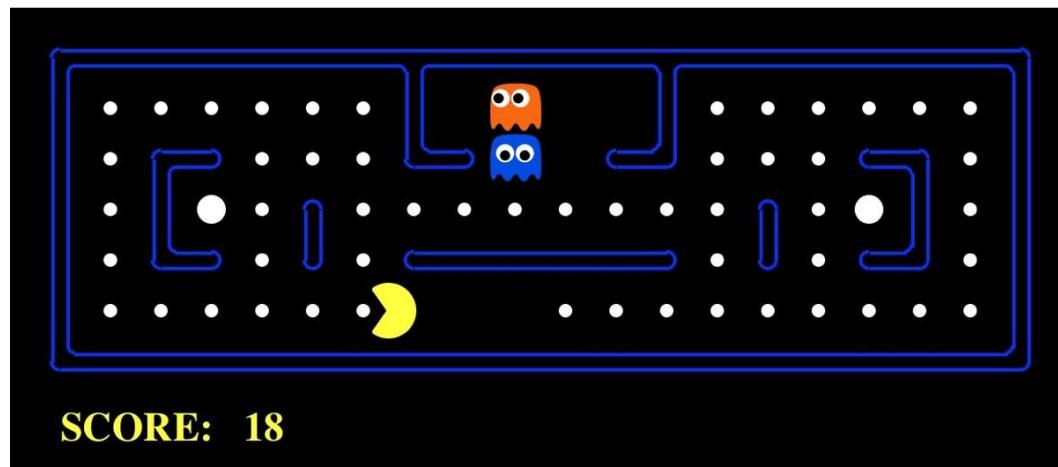
Percept sequence	Action
$[A, Clean]$	<i>Right</i>
$[A, Dirty]$	<i>Suck</i>
$[B, Clean]$	<i>Left</i>
$[B, Dirty]$	<i>Suck</i>
$[A, Clean], [A, Clean]$	<i>Right</i>
$[A, Clean], [A, Dirty]$	<i>Suck</i>
:	:

```
function REFLEX-VACUUM-AGENT([location,status]) returns an action
    if status = Dirty then return Suck
    else if location = A then return Right
    else if location = B then return Left
```

What is the **right** function?

Can it be implemented in a small agent program?

Pac-Man as an Agent



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

Demo1: pacman-l1.mp4 or L1D2

Course Topics

Core Components of Rational Agents:

Search &
Planning

Reinforcement
Learning

Probability &
Inference

Supervised
Learning

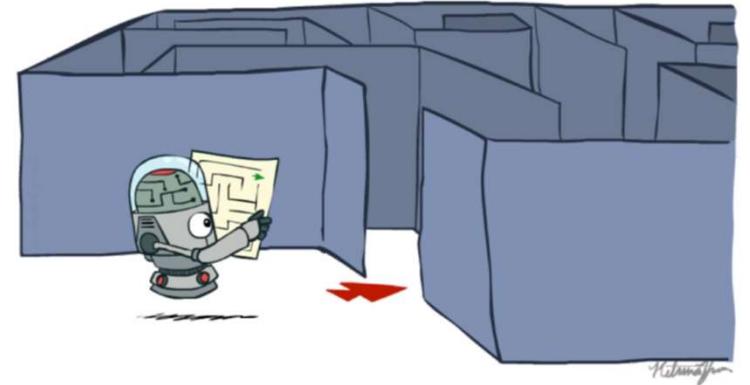
Course Topics

Search &
Planning

Reinforcement
Learning

Probability &
Inference

Supervised
Learning



How can I find a *sequence of best decisions* for a
particular situation?

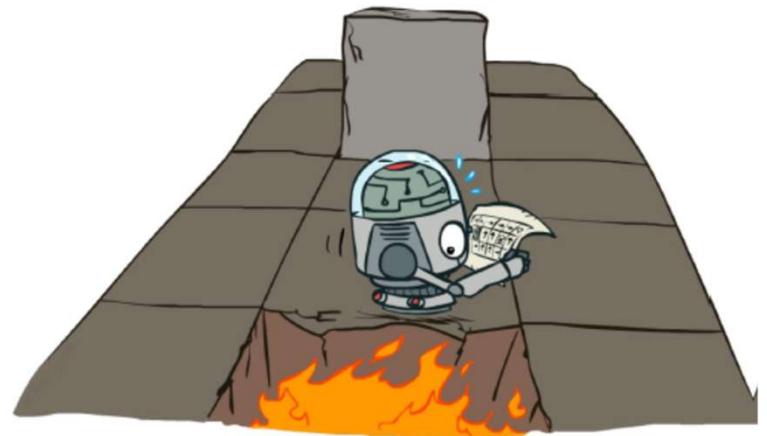
Course Topics

Search &
Planning

Reinforcement
Learning

Probability &
Inference

Supervised
Learning



How can I find **rules (policy)** to make best decisions for **any** situation?

Course Topics

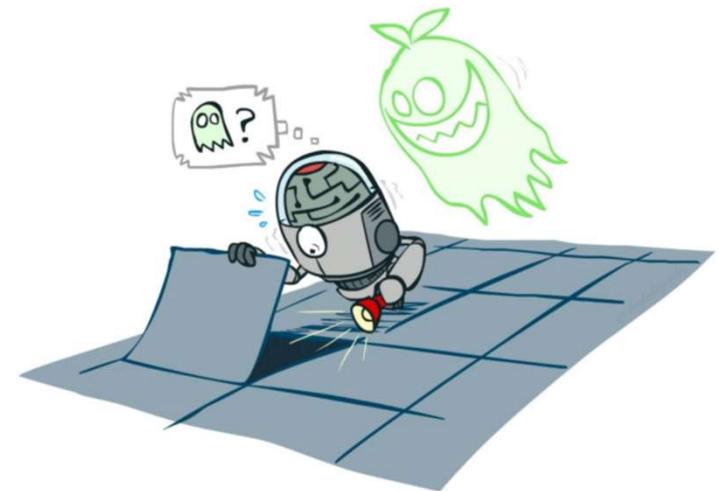
Search &
Planning

Reinforcement
Learning

Probability &
Inference

Supervised
Learning

How can I make sense of *uncertainty* in the world?



Search &
Planning

Reinforcement
Learning

Probability &
Inference

Supervised
Learning



How can I learn a *model* of the world from *data*?