

CS 246: Artificial Intelligence



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Instructor: Br. Tamal Mj

Image credit
<https://futureoflife.org/>

[slides adapted from Dan Klein, Pieter Abbeel, Sergey Levine & Stuart Russell
(University of California, Berkeley)]



Om Saha Naav[au]-Avatu
Saha Nau Bhunaktu
Saha Viiryam Karavaavahai
Tejasvi Naav[au]-Adhiitam-
Astu Maa Vidvissaavahai
Om Shaantih Shaantih
Shaantih

Om, May we all be protected
May we all be nourished
May we work together with great energy
May our intellect be sharpened (may our study be effective)
Let there be no Animosity amongst us
Om, peace (in me), peace (in nature), peace (in divine forces)

Course Information

- Instructor:
 - Br. Tamal Mj
- Communication:
 - Google Classroom
 - Email: tamal@gm.rkmvu.ac.in
- Office Hours:
 - You are always welcome!
 - Making appointment is recommended

Course Information

- Prerequisites:

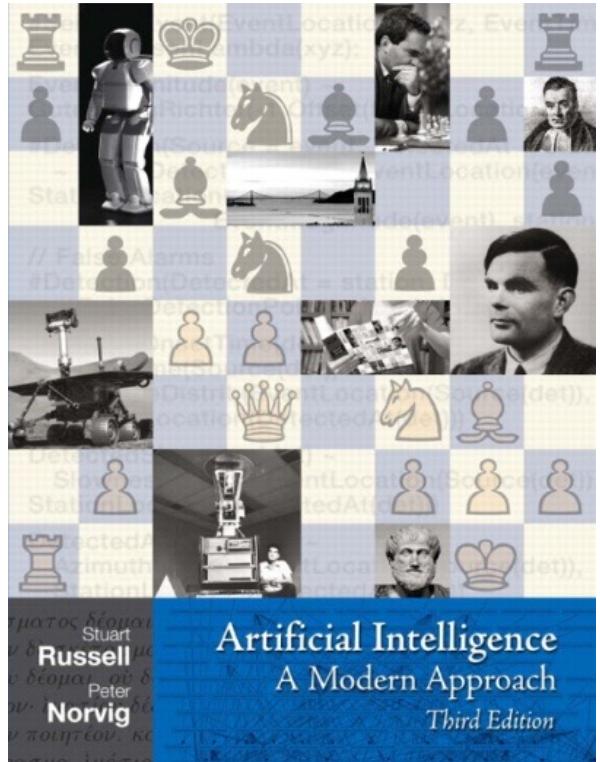
- Basic Probability
- Basic Data Structures and Algorithms
- Willingness to learn

- Work and Grading:

- Combination of Projects and/or Assignments
- Around 10 quizzes/assignments
- One Midterm, one final

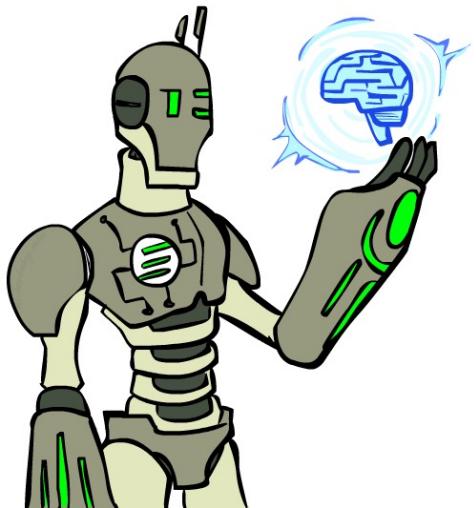
Textbook

- Artificial Intelligence:
A Modern Approach,
3rd / 4th Edition
by Russell & Norvig
- Our presentation does not necessarily follow the presentation in the book.

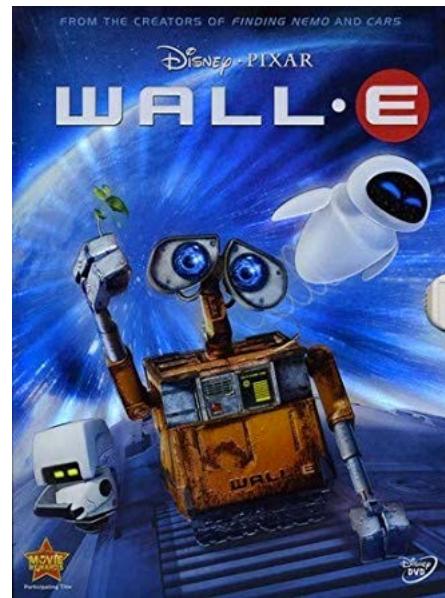


Today

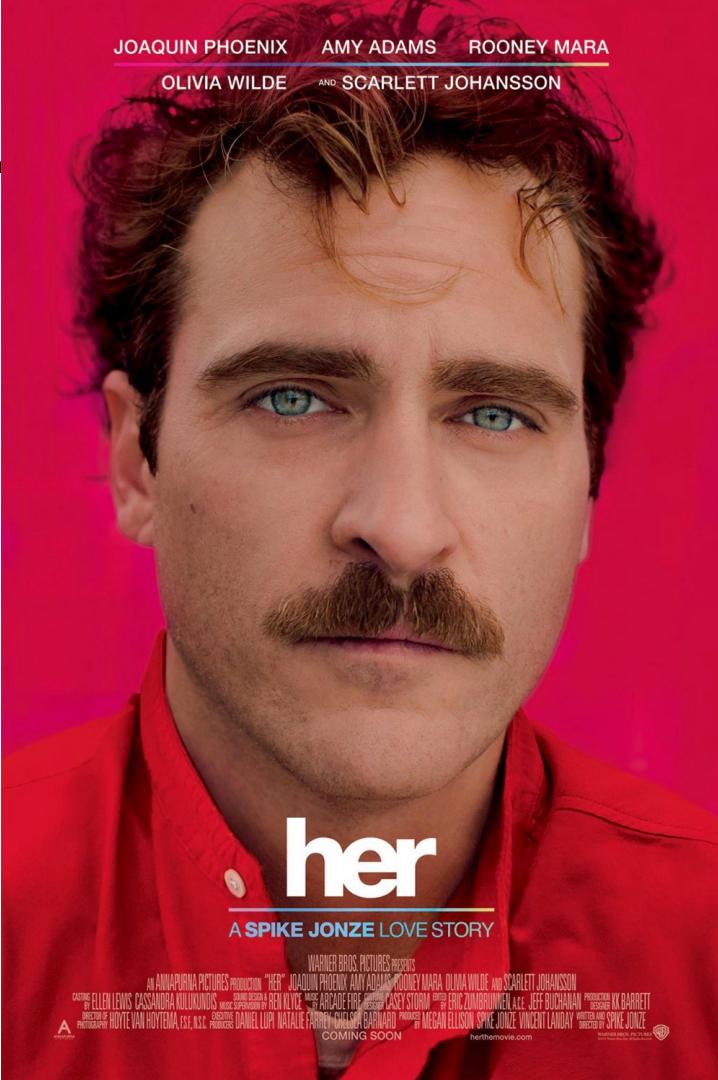
- What is artificial intelligence?
- What can AI do?
- What is this course about?



Sci-Fi AI?



JOAQUIN PHOENIX AMY ADAMS ROONEY MARA
OLIVIA WILDE AND SCARLETT JOHANSSON



DOMHNALL GLEESON ALICIA VIKANDER and OSCAR ISAAC



What is AI?

The science of making machines that:

Rational Decisions

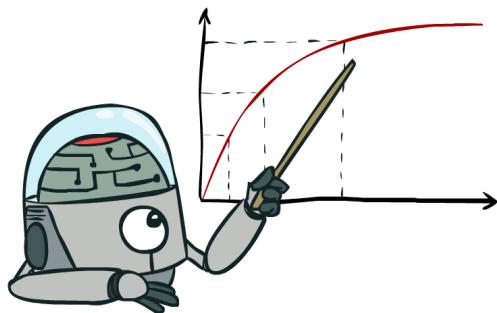
We'll use the term **rational** in a very specific, technical way:

- 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:

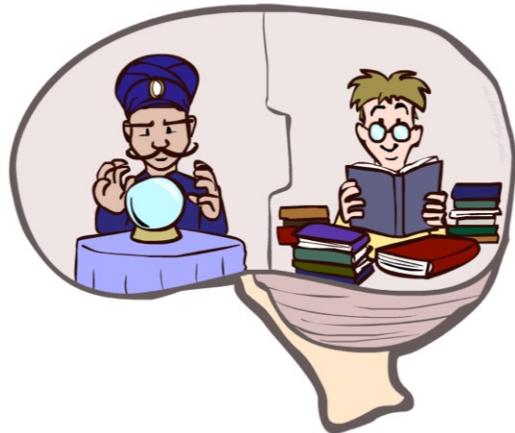
Computational Rationality

Maximize Your Expected Utility

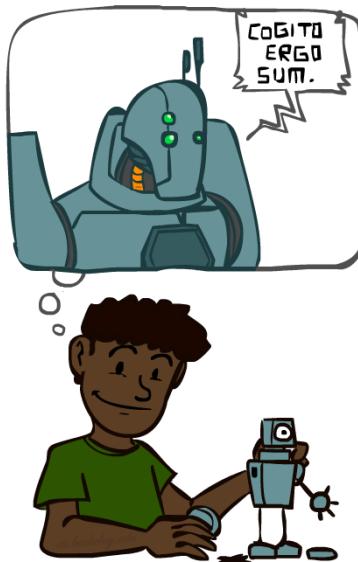


What About the Brain?

- 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



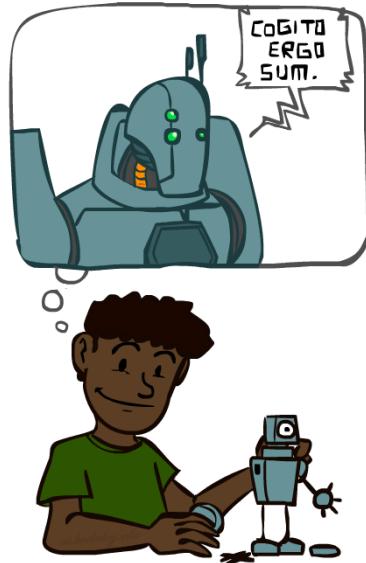
Demo: HISTORY – MT1950.wmv

The Thinking Machine (Documentary)

- <https://youtu.be/5YBIrc-6G-0>

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 Kolkata Street?
- ✓ Buy a week's worth of groceries on the web?
- ✗ Buy a week's worth of groceries from Bally Bazar?
- ❓ 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?



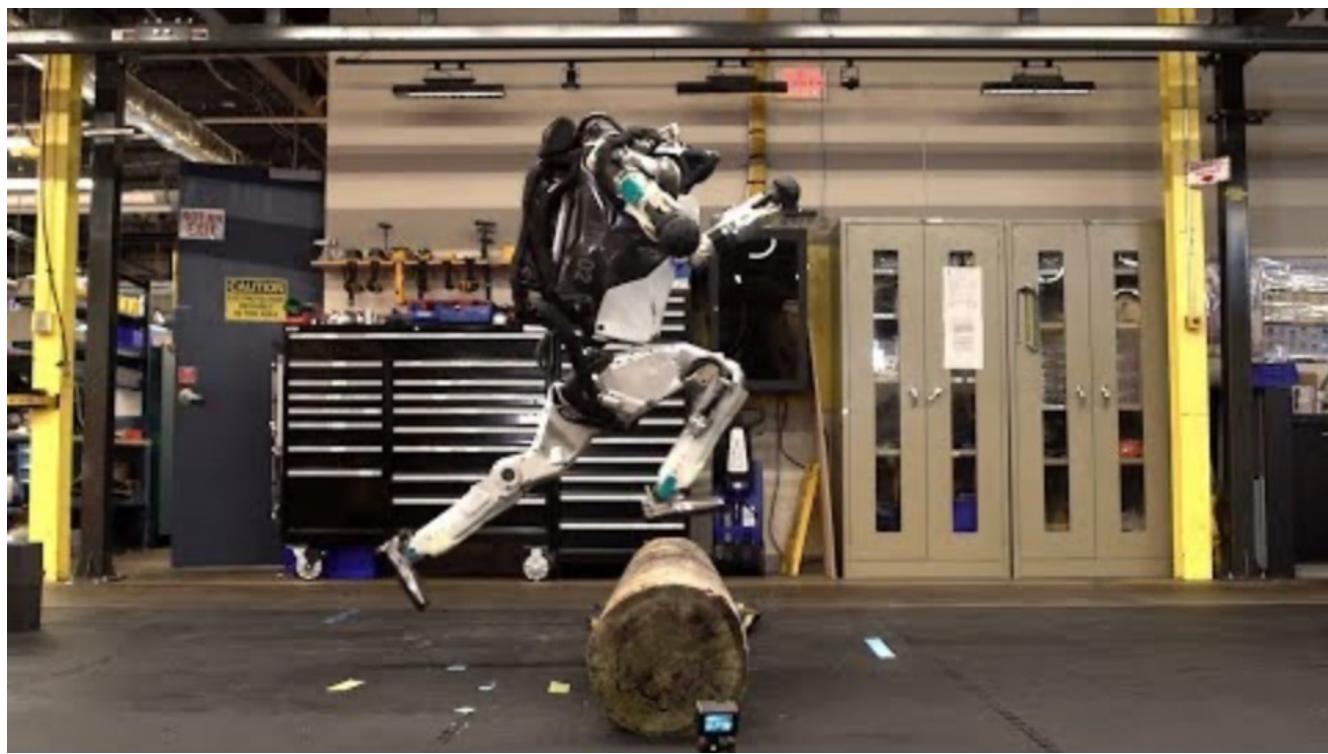
Videos!!!

- <https://www.youtube.com/watch?v=dKjCWfuvYxQ>
- https://www.youtube.com/watch?v=-e1_QhJ1EhQ
- <https://www.youtube.com/watch?v=LikxFZZO2sk>
- <https://www.youtube.com/watch?v=tF4DML7FIWk>
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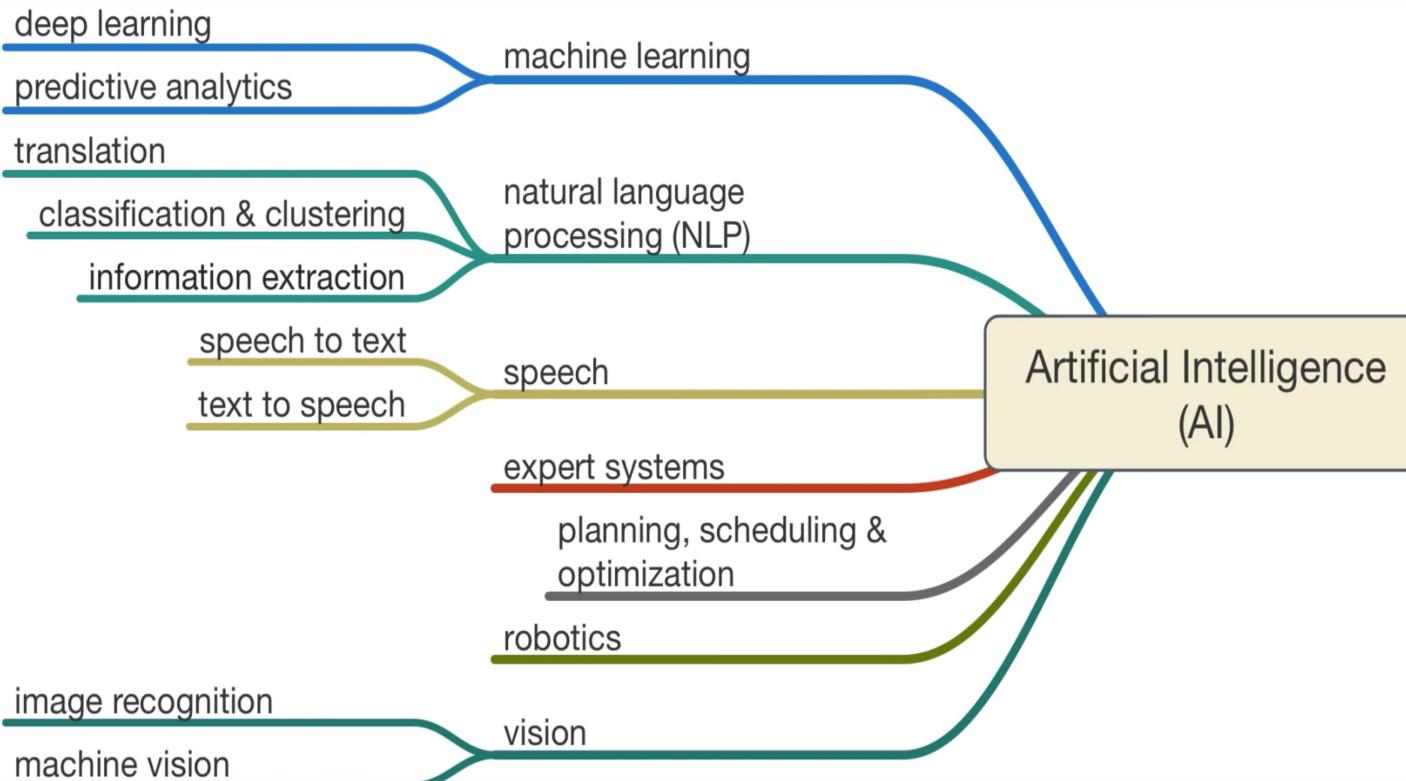
big guacamole

2019: look at this robot running and jumping

2050: just our fearless dictator getting a morning jog

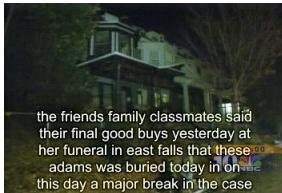


Applications



Natural Language

- Speech technologies (e.g. Siri)
 - Automatic speech recognition (ASR)
 - Text-to-speech synthesis (TTS)
 - Dialog systems
- Language processing technologies
 - Question answering
 - Machine translation



"Il est impossible aux journalistes de rentrer dans les régions tibétaines"

Bruno Philip, correspondant du "Monde" en Chine, estime que les journalistes de l'AFP qui ont été expulsés de la province tibétaine du Qinghai "n'étaient pas dans l'ilégalité".

Les faits Le dalaï-lama dénonce l'"enfer" imposé au Tibet depuis sa fuite, en 1959
Video Anniversaire de la rébellion tibétaine: le Dalai Lama dénonce



Photo: AP

"It is impossible for journalists to enter Tibetan areas"

Philip Bruno, correspondent for "World" in China, said that journalists of the AFP who have been deported from the Tibetan province of Qinghai "were not illegal."

Facts The Dalai Lama denounces the "hell" imposed since he fled Tibet in 1959
Video Anniversary of the Tibetan rebellion: China on guard

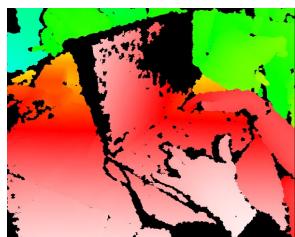
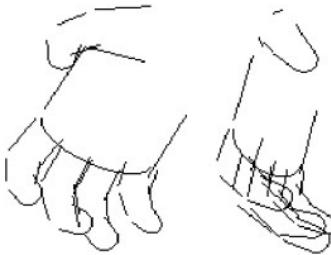
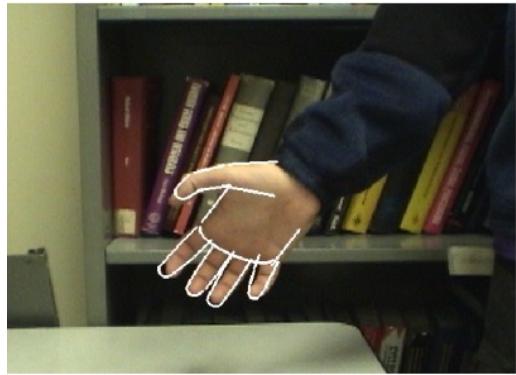


Photo: AP

- Web search
- Text classification, spam filtering, etc...

Vision (Perception)

- Object and face recognition
- Scene segmentation
- Image classification



Images from Erik Sudderth (left), wikipedia (right)

Demo1: VISION – lec_1_t2_video.flv

Demo2: VISION – lec_1_obj_rec_0.mpg

Robotics

- Robotics
 - Part mech. eng.
 - Part AI
 - Reality much harder than simulations!
- Technologies
 - Vehicles
 - Rescue
 - Soccer!
 - Lots of automation...
- In this class:
 - We ignore mechanical aspects
 - Methods for planning
 - Methods for control



Images from UC Berkeley, Boston Dynamics, RoboCup, Google

Demo 1: ROBOTICS – soccer.avi

Demo 2: ROBOTICS – soccer2.avi

Demo 3: ROBOTICS – gcar.avi

Demo 4: ROBOTICS – laundry.avi

Demo 5: ROBOTICS – petman.avi

Game Playing

- Classic Moment: May, '97: Deep Blue vs. Kasparov
 - First match won against world champion
 - “Intelligent creative” play
 - 200 million board positions per second
 - Humans understood 99.9 of Deep Blue's moves
 - Can do about the same now with a PC cluster
- Open question:
 - How does human cognition deal with the search space explosion of chess?
 - Or: how can humans compete with computers at all??
- 1996: Kasparov Beats Deep Blue

“I could feel --- I could smell --- a new kind of intelligence across the table.”
- 1997: Deep Blue Beats Kasparov

“Deep Blue hasn't proven anything.”
- Huge game-playing advances recently, e.g. in Go!



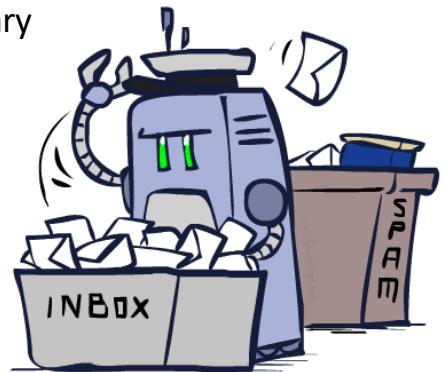
Text from Bart Selman, image from IBM's Deep Blue pages

Decision Making

- Applied AI involves many kinds of automation



- Scheduling, e.g. airline routing, military
- Route planning, e.g. Google maps
- Medical diagnosis
- Web search engines
- Spam classifiers
- Automated help desks
- Fraud detection
- Product recommendations
- ... Lots more!

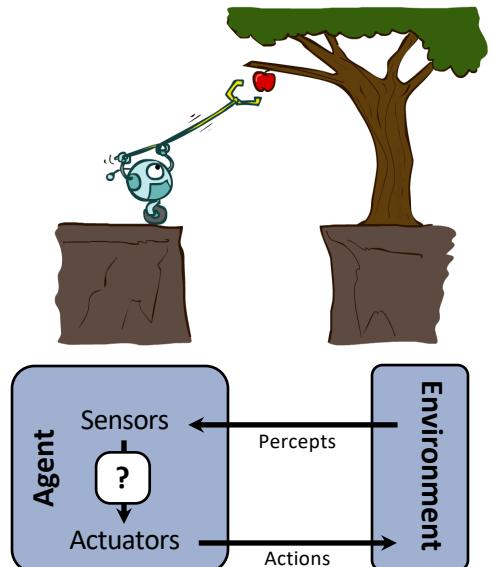


GPTs

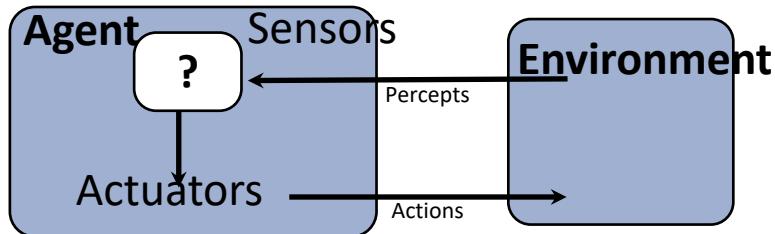
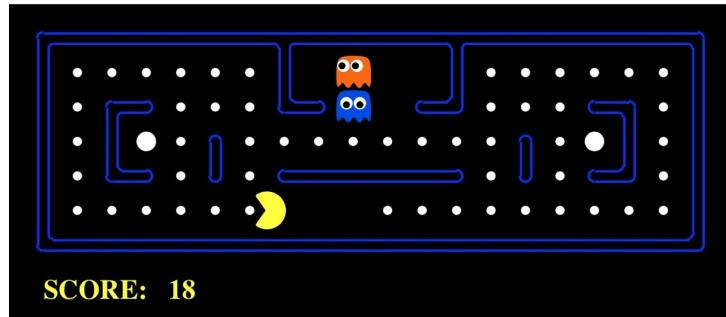
- Is there anyone who doesn't know about it?

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

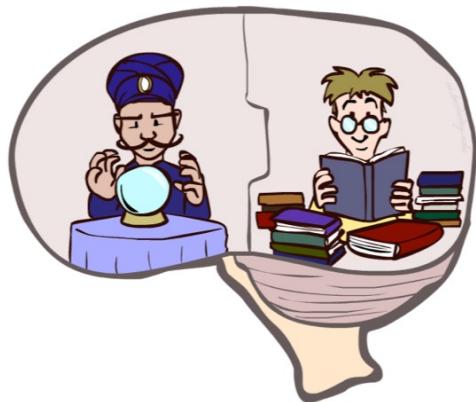


Pac-Man is a registered trademark of Namco-Bandai Games, used here for educational purposes

Demo1: [pacman-l1.mp4](#) or [L1D2](#)

Course Topics

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



Course Syllabus (tentative)

Already Shared

Grading

- Quizzes: 20%
- Projects and/or Assignments: 30%
- Midterm Exam: 20%
- Final Exam: 30%

POLICIES

Attendance

- The class starts at 10:30 am on Mondays and 3:00 pm on Thursdays
- Make sure you are present by that time
- We may finish early but no coming late is absolutely not allowed.



teachers
call it
cheating,
we call it
teamwork

Group study/discussion is encouraged, but the submission must be your own work! If you use a piece of code from internet, say so!

How to contact me?

- Send me an email
 - tamal@gm.rkmvu.ac.in
- Appointment via email

Programming

- Mainly Python

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- Thank you all!

Acknowledgements

- [These slides were created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley. All materials available at <http://ai.berkeley.edu>.]