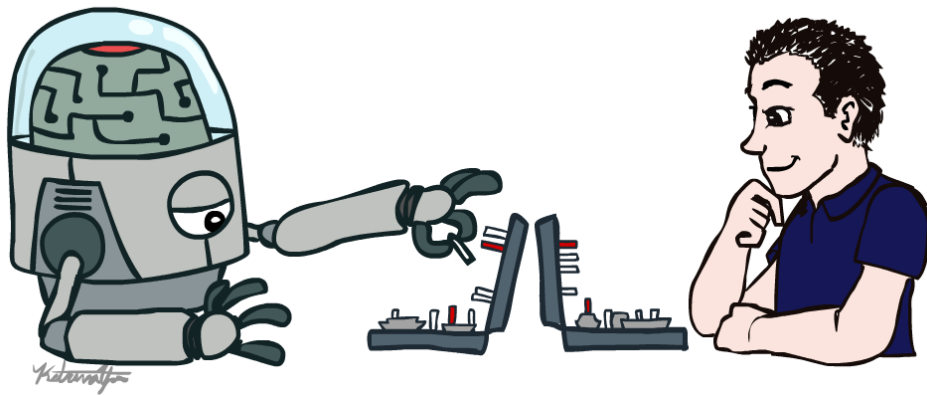


CS 188: Artificial Intelligence

Introduction



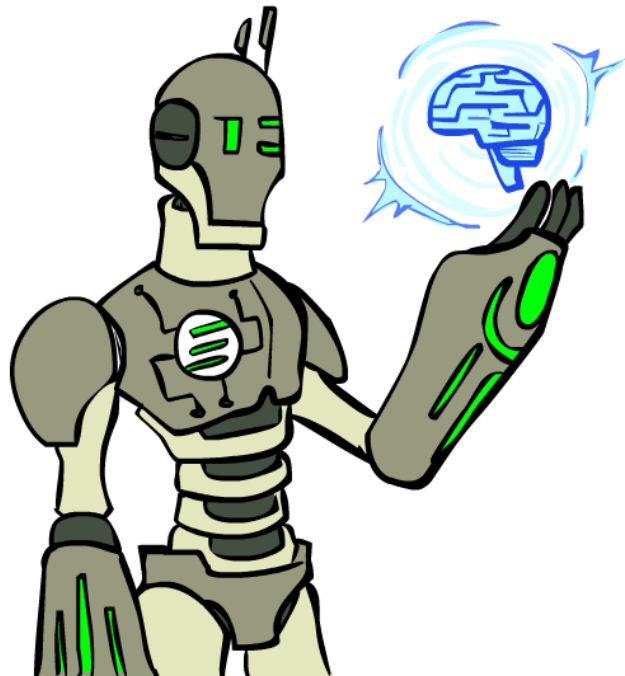
Instructors: Anwar Baroudi, Daniel Fried

University of California, Berkeley

(slides adapted from Dan Klein, Pieter Abbeel, Anca Dragan, Sergey Levine)

Today

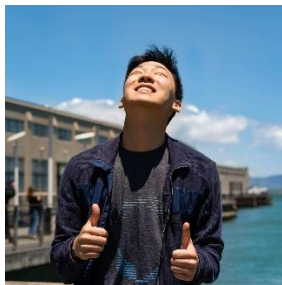
- What is artificial intelligence?
- Where did it come from?
- What can AI do?
- What is this course?



Course Staff



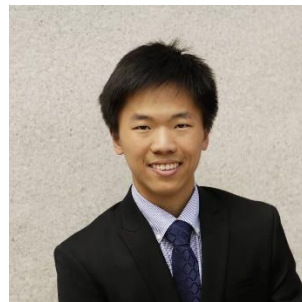
Alex



Austen



Diana



Mesut



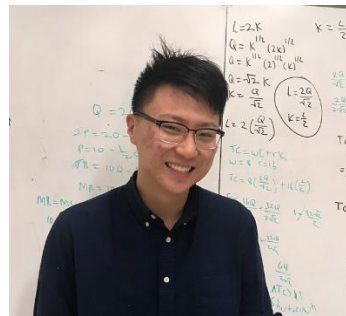
Micah



Noah

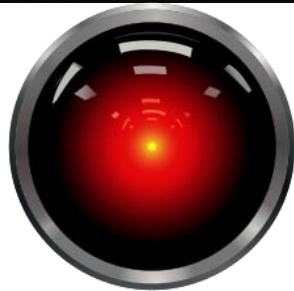
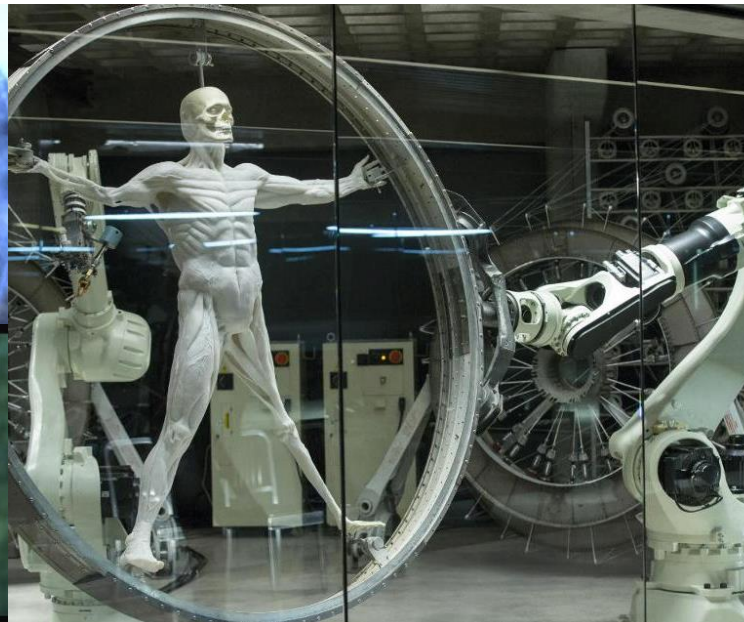


Roshan

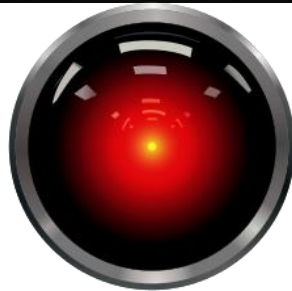
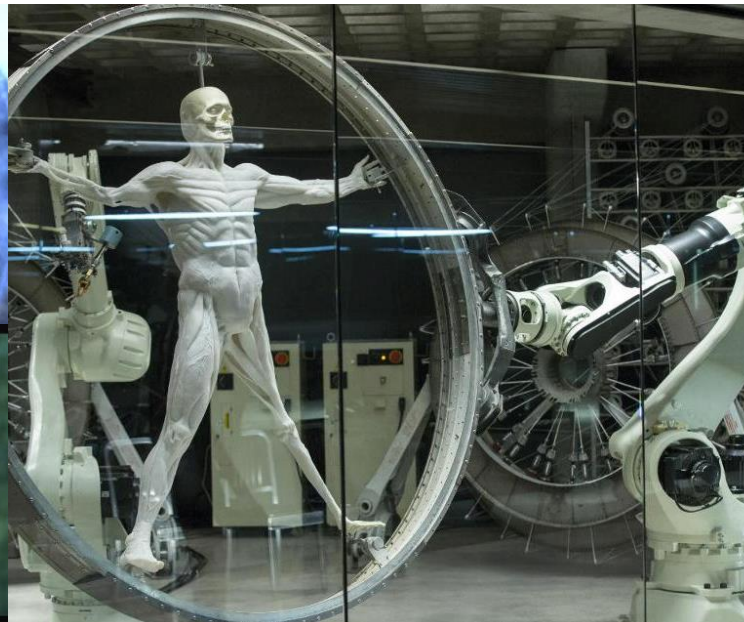


Tony

AI



Sci-Fi AI



AI in the News

theguardian
Winner of the Pulitzer prize

US world opinion sports soccer tech arts lifestyle fashion business money travel environment all sections

home > tech games

Artificial intelligence (AI)

Elon Musk: artificial intelligence is our biggest existential threat

The AI investor says that humanity risks 'summoning a demon' and calls for more regulatory oversight

Samuel Gibbs
@SamuelGibbs

Monday 27 October 2014
06.26 EDT

< Shares 7853 Comments 673



Artificial intelligence should be regulated, says Elon Musk. Photograph: Blutgruppe/Blutgruppe/Corbis

[Elon Musk](#) has spoken out against artificial intelligence (AI), declaring it the most serious threat to the survival of the human race.

Musk made the comments to students from Massachusetts Institute of Technology (MIT) [during an interview at the AeroAstro Centennial Symposium](#), talking about computer science, AI, space exploration and the colonisation of Mars.

AI in the News



SCIENCE

**Elon Musk Funds 1 Billion-
Dollar Project To Save Mankind
From Artificial Intelligence**

Source: WakingScience

Center for Human-Compatible AI

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theguardian

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Artificial intelligence (AI)

The rise of robots: forget evil AI – the real risk is far more insidious

It's far more likely that robots would inadvertently harm or frustrate humans while carrying out our orders than they would rise up against us

Olivia Solon in San Francisco

Tuesday 30 August 2016 09.00 EDT

[f](#) [t](#) [e](#) [...](#)

This article is 5 months old



Advertisement

The All-New
PRIUS PRIME

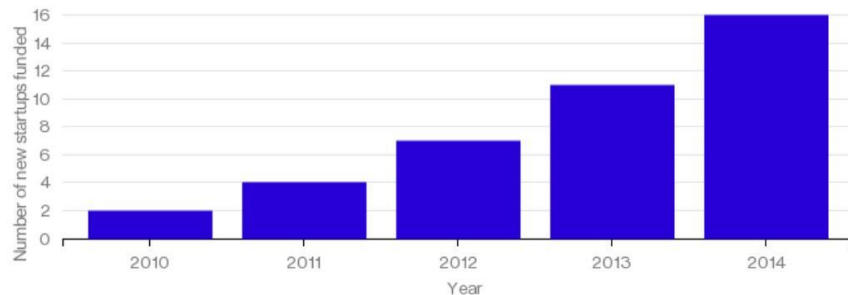
Standard backup camera.¹
Available 11.6-in. HD multimedia display.



AI Booming in Industry

HAL 9000 Is Coming

Newly funded artificial intelligence startups, by year

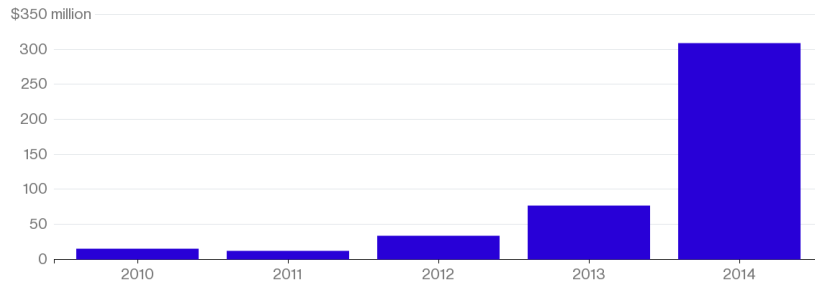


Data: CB Insights

Bloomberg 

Artificial Intelligence, Real Money

Total venture capital money for pure AI startups, by year



Source: CB Insights

Bloomberg 

What is AI?

The science of making machines that:

Rational Decisions

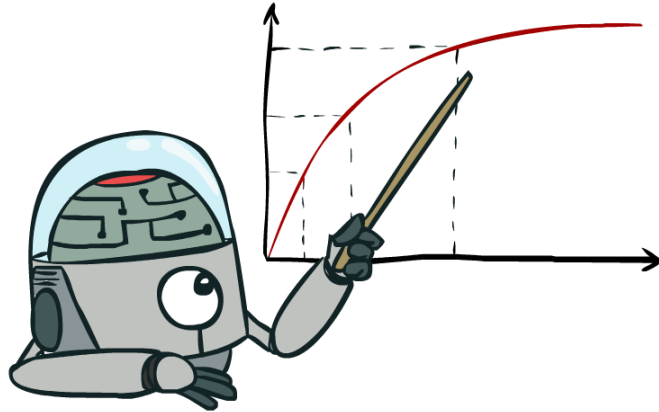
We'll use the term **rational** in a very specific, technical way:

- 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



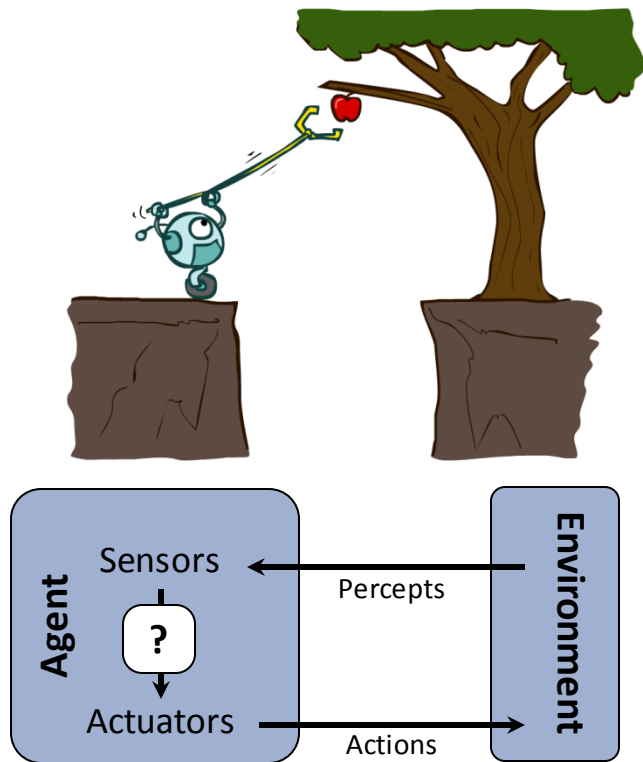
What About the Brain?

- 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

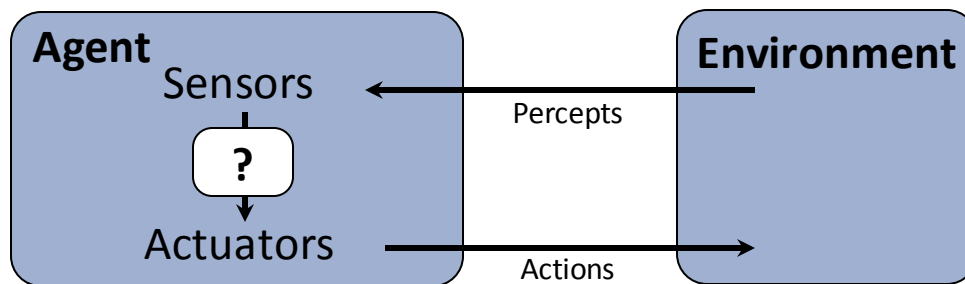
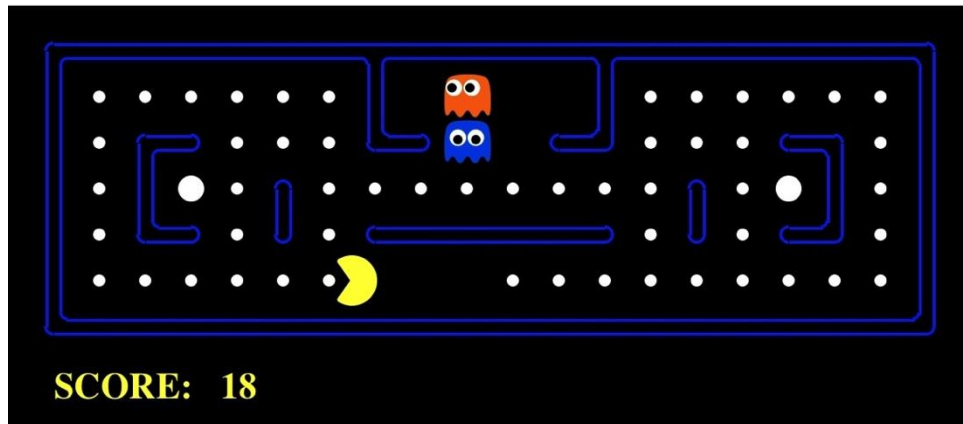


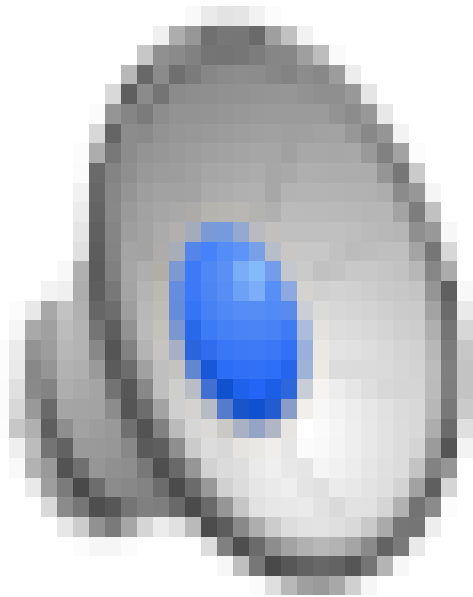
Designing Rational Agents

- 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





Course Topics

- Part I: Making Decisions
 - Fast search / planning
 - Constraint satisfaction
 - Adversarial and uncertain search
- Part II: Reasoning under Uncertainty
 - Bayes' nets
 - Decision theory
 - Machine learning



AI

Machine Learning

[learning decisions;
sometimes independent]

Robots

[physically
embodied]

**Rational
Agents**

[decisions]

**Human-AI
Interaction**

NLP

**Computer
Vision**

Logistics!

Website

- Website – sign up!
 - tentative schedule
 - homework, projects, lecture slides and notes, course policies, etc.
 - use your berkeley id
 - Policies/other pages in construction, syllabus up to date

https://edge.edx.org/courses/course-v1:BerkeleyX+CS188+2018_SU/info



BerkeleyX: CS188

Artificial Intelligence - Berkeley (Spring 2018)

Gradescope

- Gradescope – sign up!
 - Used for submitting Projects and seeing exams
 - Find our class and enroll yourself using entry code: **98NNJZ**
 - Use your berkeley email
 - Make sure there is an SID associated with your account

Piazza

- Communication:

- piazza – ask and answer questions; announcements
- private matters – private messages
- if you really need to, here is the staff email:
cs188su18@lists.berkeley.edu
- exceptions – email Noah (head GSI) at noah.golmant@berkeley.edu

Course Format

- Lectures MTWThu

- I want for you to show up and actively engage
- Video recordings
 - None

- Discussion Sections

- 3; schedule announced on piazza
- Pick 1 to go to; show up to it consistently -> bonus 1%
- Videos posted at end of the week
- No sections today or tomorrow

Course Format (continued)

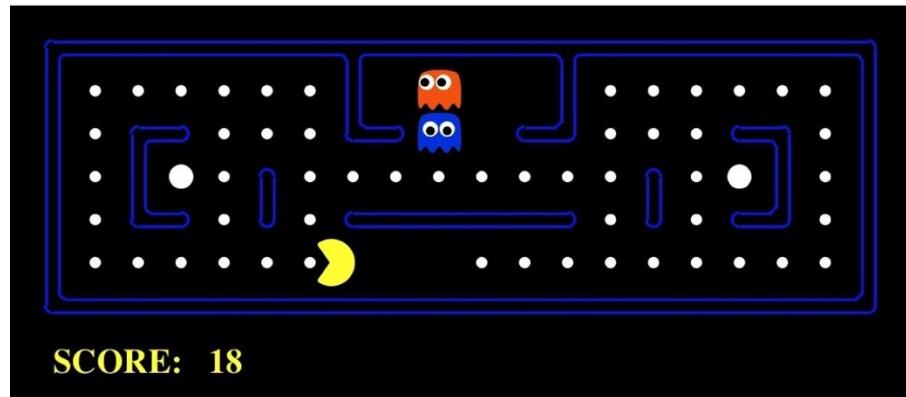
- Homework

- Typically due Sundays at midnight (11:59pm) (beware of edx timezones, often in UTC)
- Exercises based on class material
- Solve together, submit alone
 - Academic integrity!
- Autograded, multiple (but limited) submissions!
 - Can get extra by going to office hours!
- I expect you to get 100% on homework
- *No slip days*

Course Format (continued)

- Projects

- Typically due Tuesdays at midnight
 - 5 slip days, max 2 per project
- 6 projects, groups of 1-2
 - Academic integrity!
- Python, hands-on experience with the algorithms
- Also autograded
- I expect you to get 100% on projects
- Run autograder locally on your computer, generates a token to submit to Gradescope



Course Format (continued)

- Exams
 - Midterm: Monday, 7/16, 5-8PM
 - Final: Wednesday, 8/8, 5-8PM
 - No makeup exams
 - **Exams are the main assessment tool, so they are hard**
- Exam Practice Sessions
 - Schedule on Piazza
 - Will start next week

Course Format (continued)

- Office hours
 - Schedule on Piazza
 - TAs: concepts, projects, homework
 - Anwar and Daniel: concepts, high level guidance, administrative etc.

Prerequisites

- CS 61A and CS 61B and CS 70
- Lots of math
 - There is a math self diagnostic test on edge.edx.org – take it! (not graded)
- Lots of programming
 - There is a 0th project (P0) which we will post today
 - Due Friday at 11:59pm
 - You get no points for submitting it
 - Stay tuned via piazza

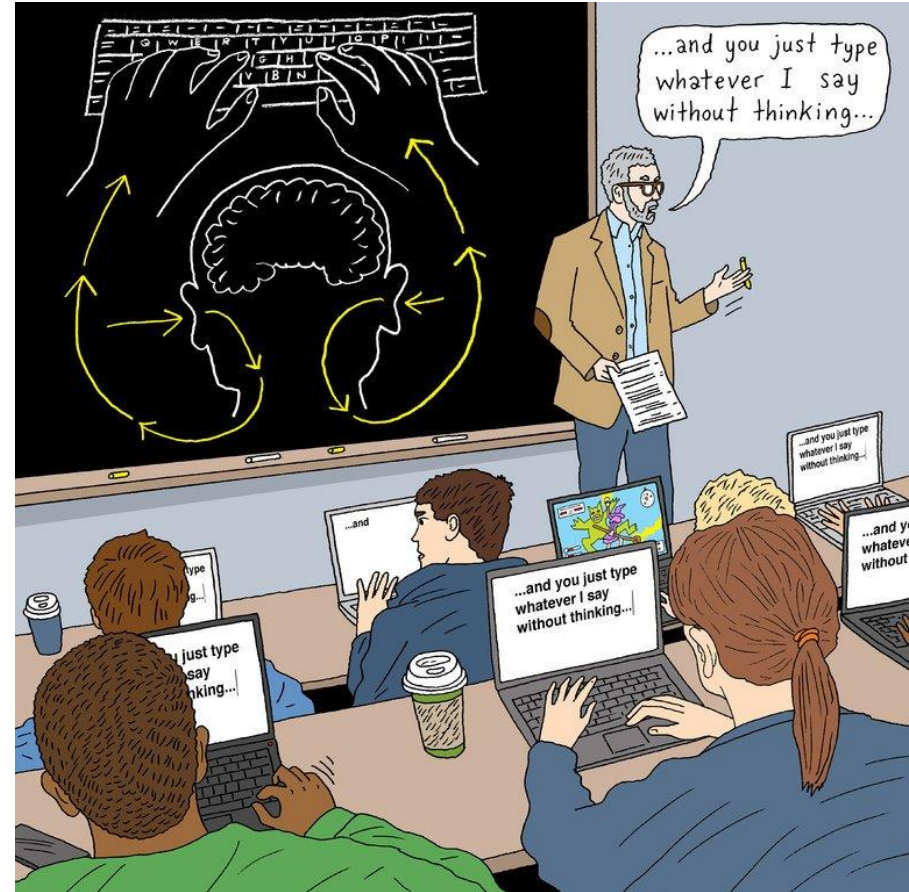
Laptops in Lecture

The New York Times

***Laptops Are Great. But Not
During a Lecture or a Meeting.***

Economic View

By SUSAN DYNARSKI NOV. 22, 2017



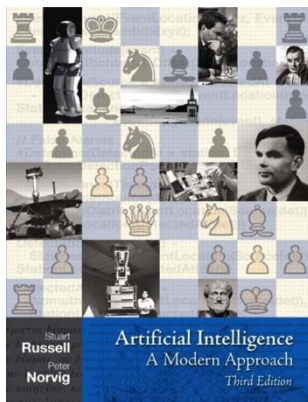
Laptops in Lecture

(starting next lecture)

- I prefer if you don't use laptops or phones in lecture.
- If you really want to use a laptop, sit in the back.
- I encourage you to sit in the front so that we can have an interaction.
- If you have special circumstances please talk to me

Textbook

- Not required, but for students who want to read more we recommend
 - Russell & Norvig, AI: A Modern Approach, 3rd Ed.

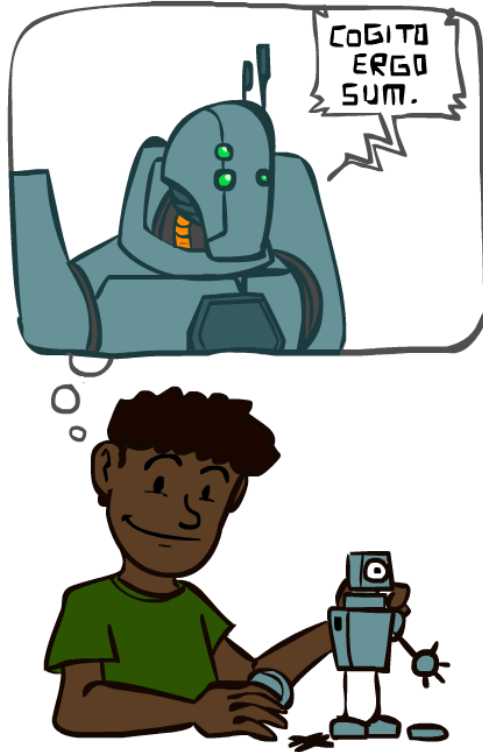


- Warning: Not a course textbook, so our presentation does not necessarily follow the presentation in the book.

Important This Week

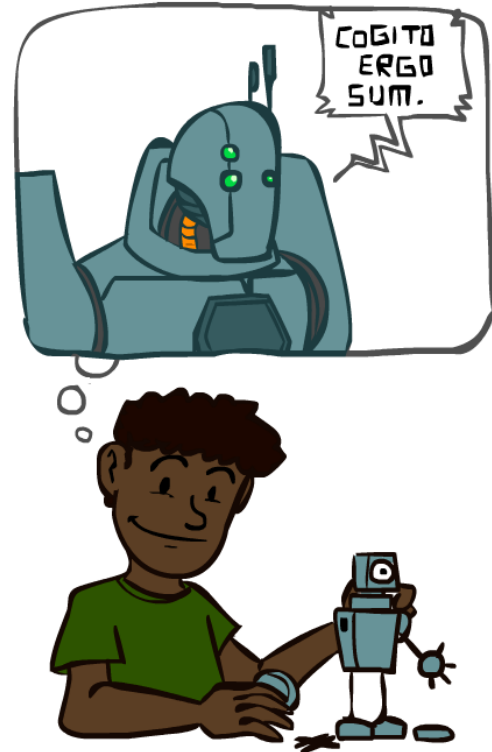
- Important this week:
 - **Register** for the class on edx and gradescope
 - **Register** for the class on piazza --- our main resource for discussion and communication
 - **P0: Python tutorial** is out (exceptionally due Friday)
 - **Math self-diagnostic** up on web page --- important to check your preparedness for second half
 - **Mark exam dates in your calendars**
- Also important:
 - **Sections** start later this week.
 - **If you are wait-listed**, talk to us, we hope to get everyone in
 - **Office Hours** start tomorrow (Tuesday).

A (Short) History of AI



A (Short) History of AI

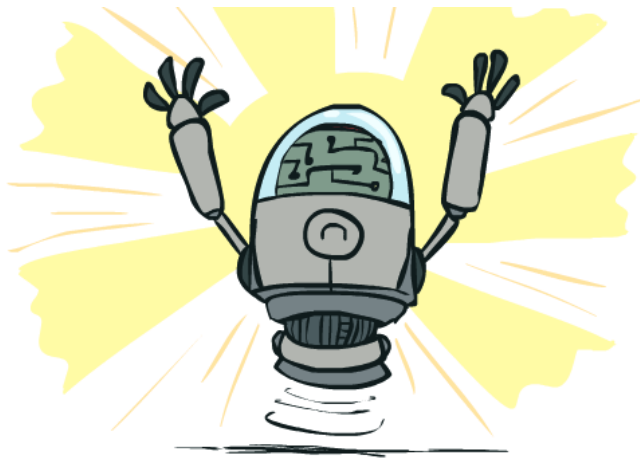
- 1940-1950: Early days
 - 1943: McCulloch & Pitts: Boolean circuit model of brain
 - 1950: Turing's "Computing Machinery and Intelligence"
- 1950—70: Excitement: Look, Ma, no hands!
 - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry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

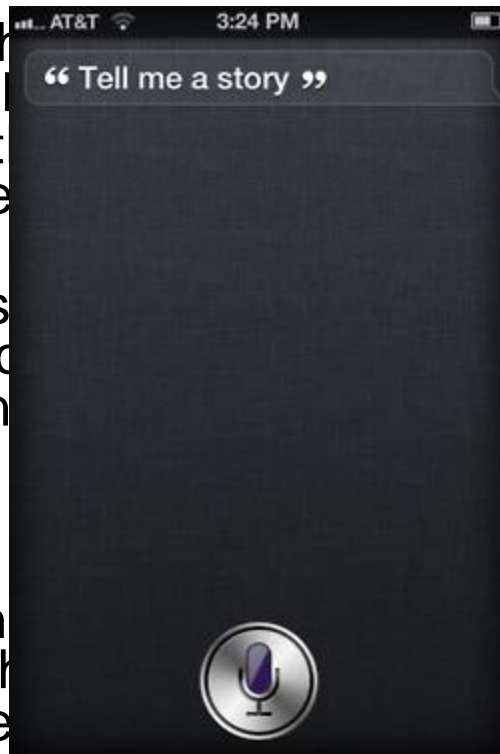
Quiz: Which of the following can be done at present?

- ✓ Play a decent game of 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 known dishwasher in collaboration with a person?
- ✓ Translate spoken Chinese into spoken English in real time?
- ✗ Write an intentionally funny story?

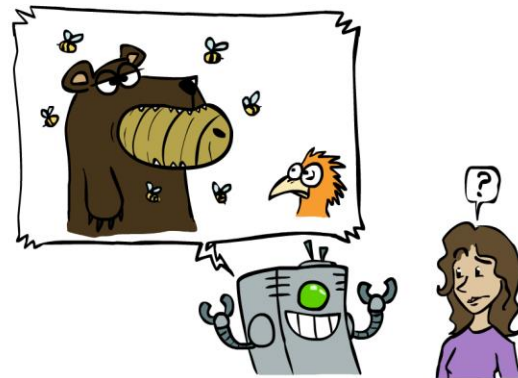


Unintentionally Funny Stories

- One day Joe Bear was h
Irving Bird where some
there was a beehive in t
the oak tree. He ate the
- Henry Squirrel was thirs
river bank where his god
Henry slipped and fell in
The End.
- Once upon a time there
the crow was sitting in h
He noticed that he was h
and swallowed the chee



friend
d him
ked to

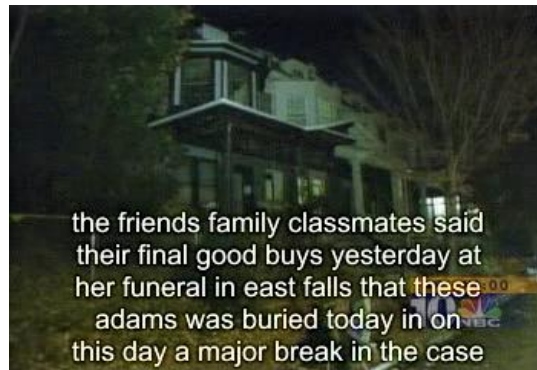


to the
sitting.
owned.

and a vain crow. One day
e of cheese in his mouth.
heese. He became hungry,
ver to the crow. The End.

Natural Language

- Speech technologies (e.g. Siri)
 - Automatic speech recognition (ASR)
 - Text-to-speech synthesis (TTS)
 - Dialog systems

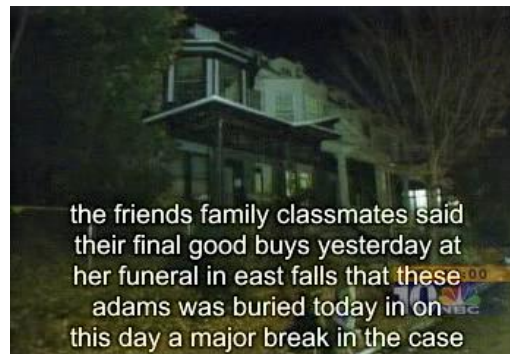


It's hard to wreck a nice beach
(recognize speech)



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'illégalité".

Les faits Le dalaï-lama dénonce l'"enfer" imposé au Tibet depuis sa fuite, en 1959

Vidéo Anniversaire de la rébellion tibétaine, la Chine sur ses gardes



"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



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

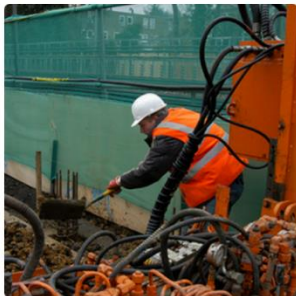
What's the difference?

- **Speech recognition**
 - Match one pattern (speech) to another (text)
 - Lots of examples – human transcription
- **Machine translation**
 - Match one pattern (English) to another (Chinese)
 - Lots of examples – human translation (e.g. United Nations proceedings)
- **Generating stories**
 - Requires common sense, outside knowledge...

Computer Vision



"man in black shirt is playing guitar."



"construction worker in orange safety vest is working on road."



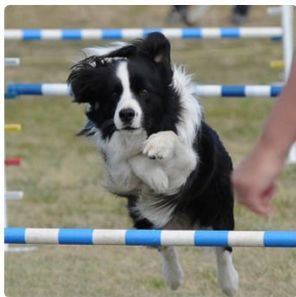
"two young girls are playing with lego toy."



"boy is doing backflip on wakeboard."



"girl in pink dress is jumping in air."



"black and white dog jumps over bar."



"young girl in pink shirt is swinging on swing."



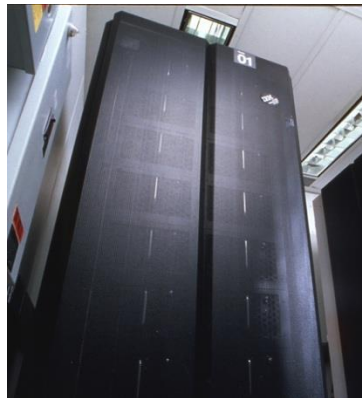
"man in blue wetsuit is surfing on wave."

Karpathy & Fei-Fei, 2015; Donahue et al., 2015; Xu et al, 2015; many more



Game Agents

- 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

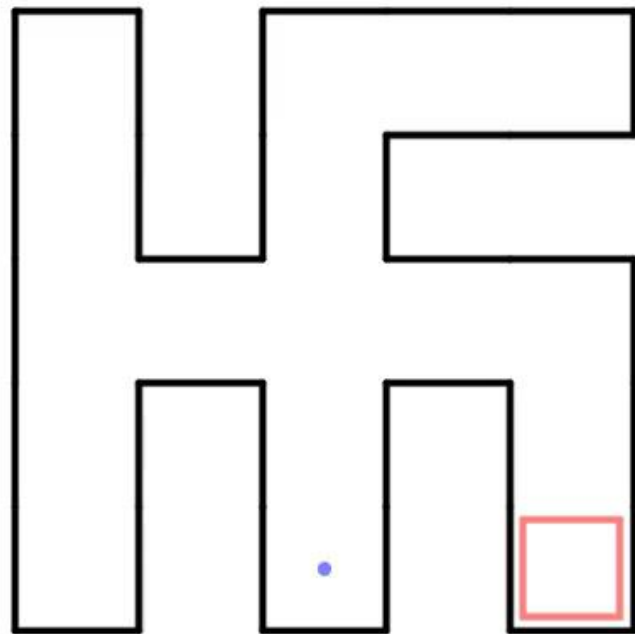


- 1996: Kasparov Beats Deep Blue
“I could feel --- I could smell --- a new kind of intelligence across the table.”
- 1997: Deep Blue Beats Kasparov
“Deep Blue hasn't proven anything.”



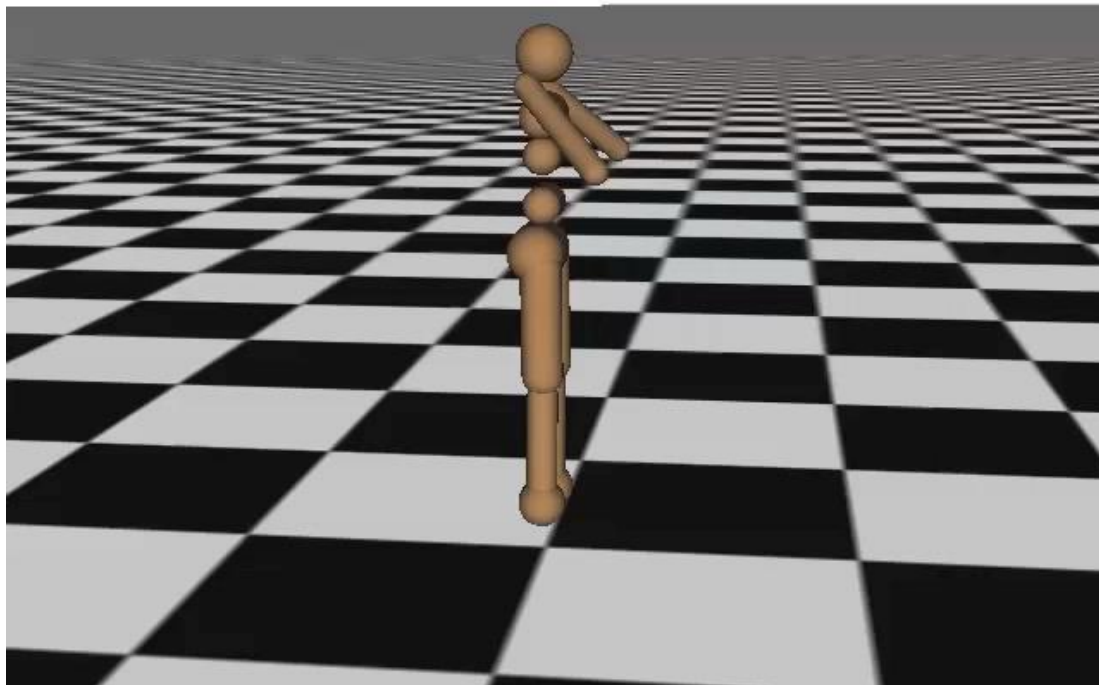


Game Agents

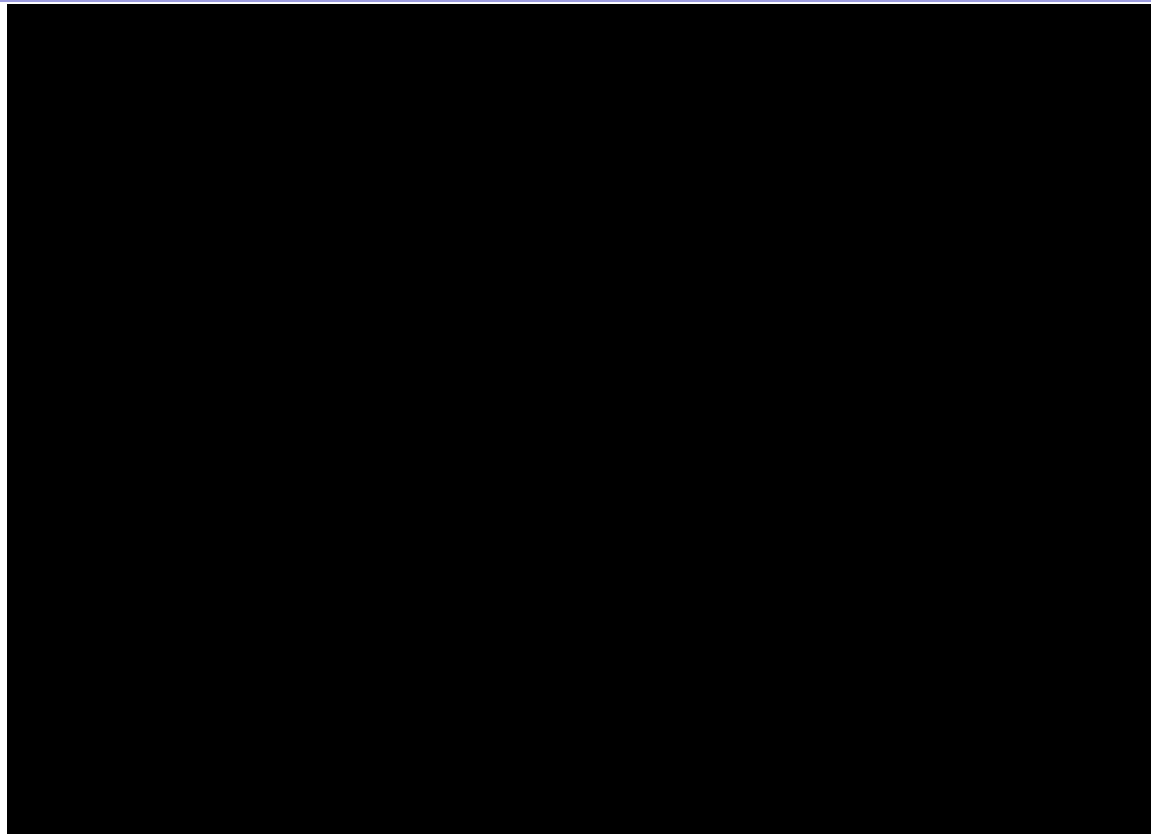


Simulated Agents

Iteration 0



Simulated Agents



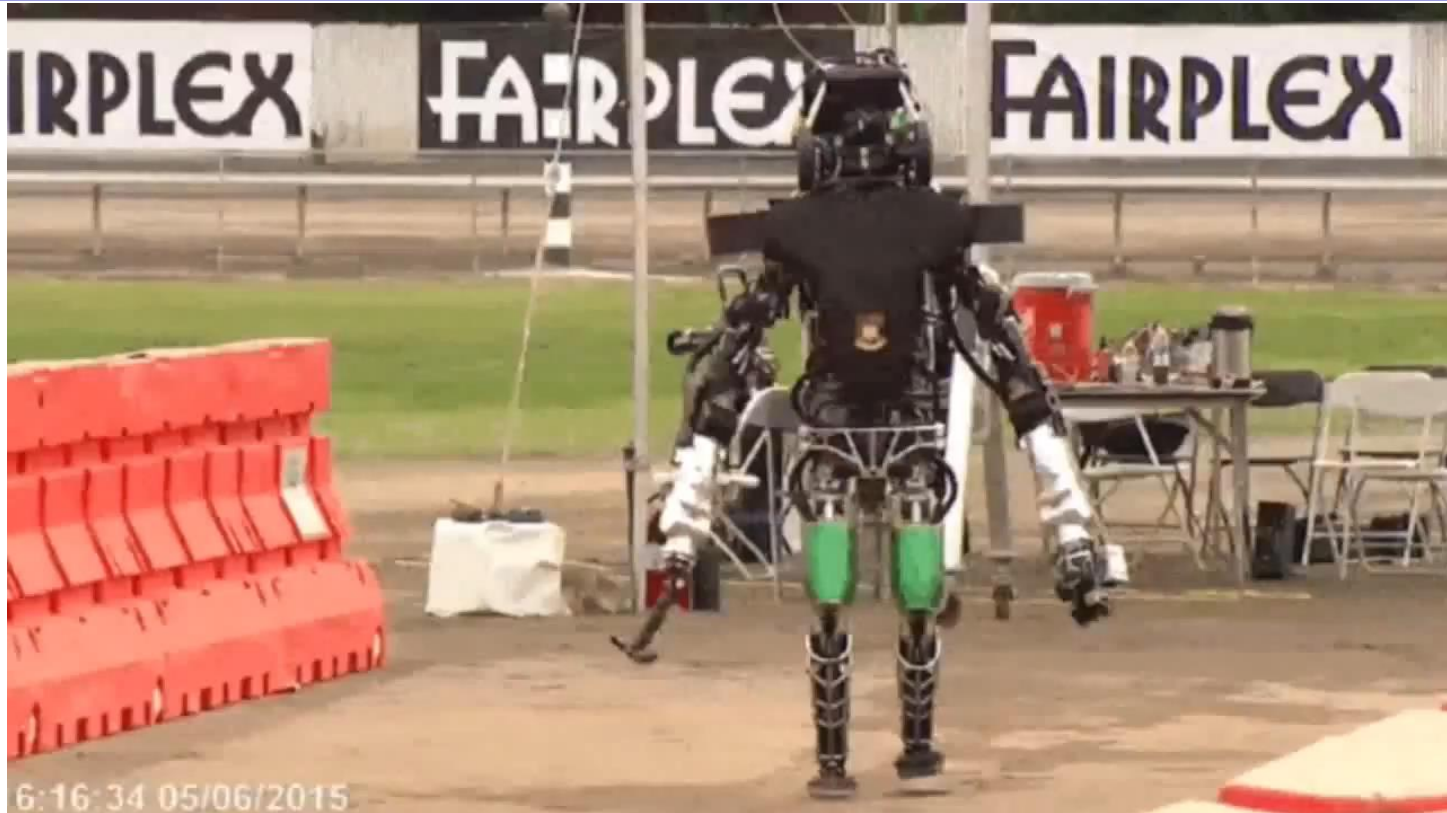
Robotics

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



Boston Dynamics Demo, 2017

What about the real world?



DARPA Robotics Challenge, 2015

What about the real world?



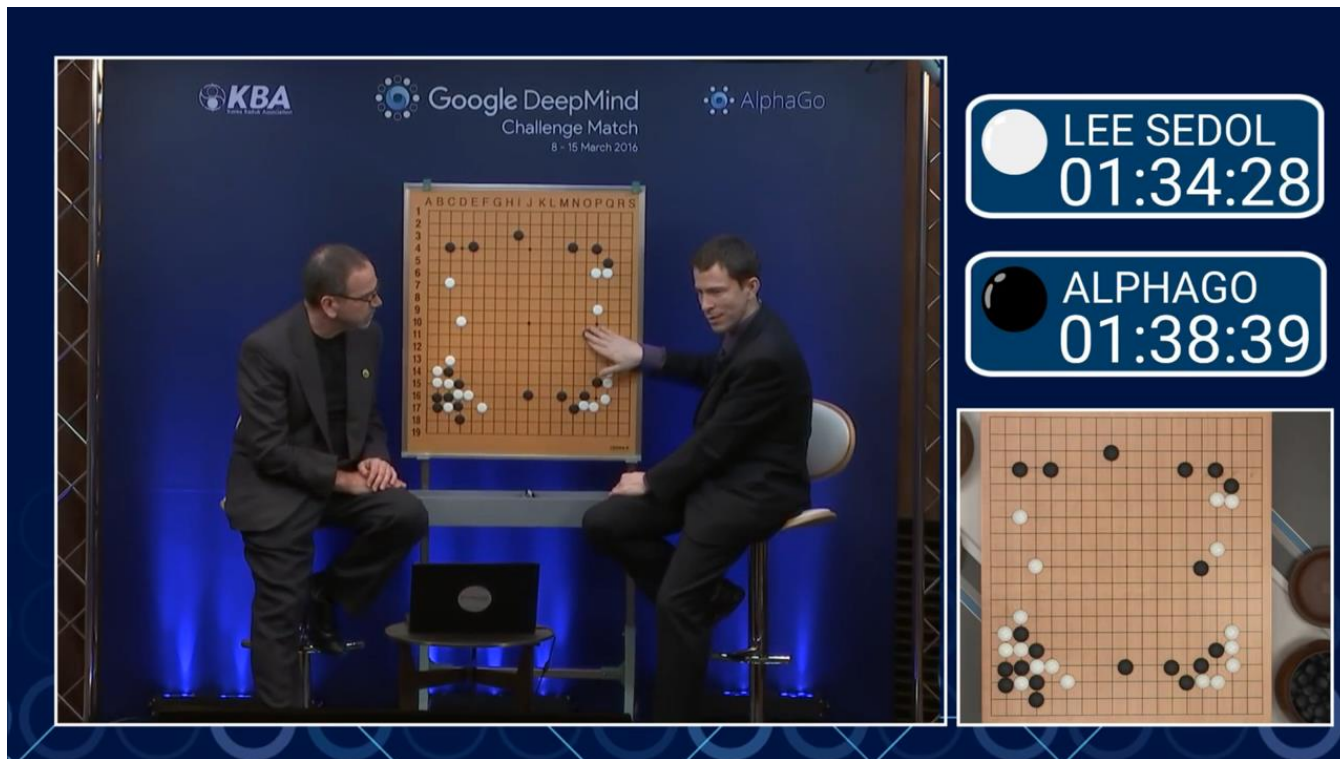
Berkeley Robot for the Elimination of Tedious Tasks (Brett)

Interacting with AI: Very Open



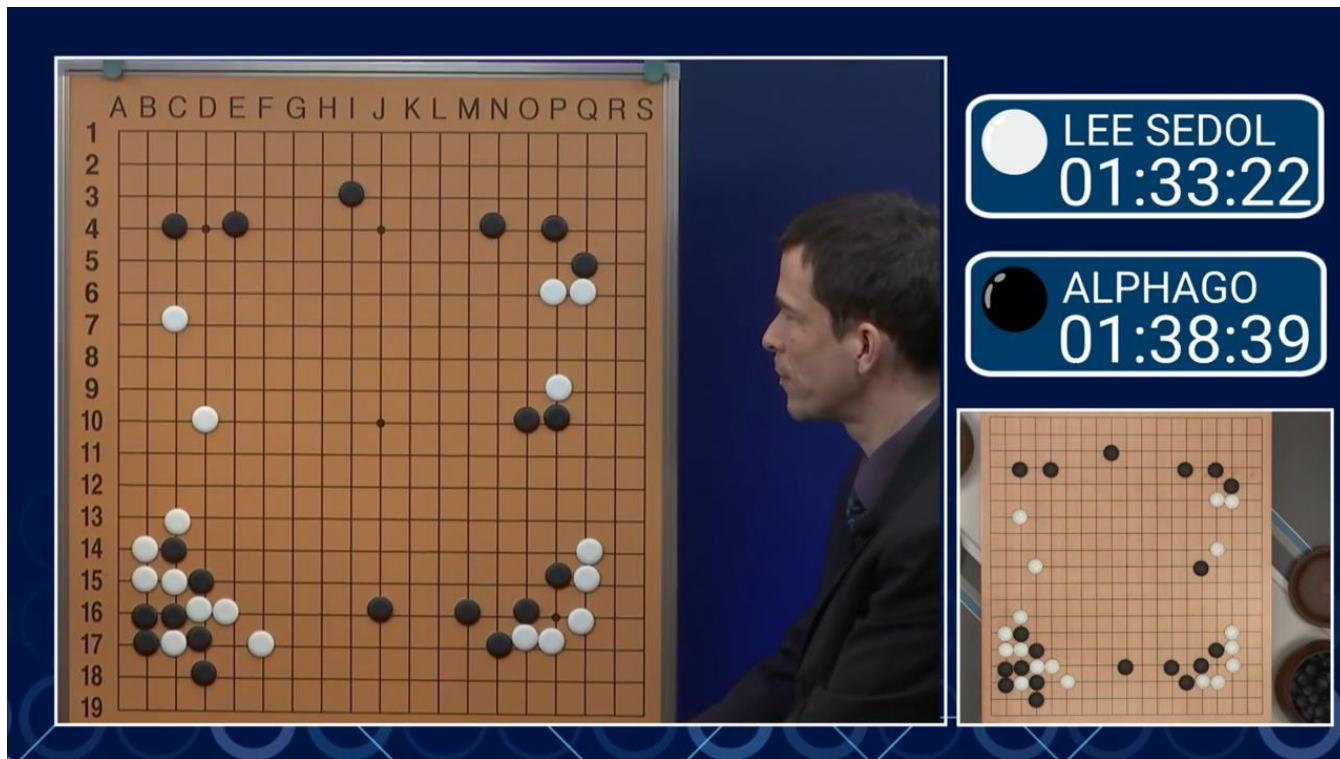
Interacting with AI: Very Open

- Why did it decide to do that?



Interacting with AI: Very Open

- Why did it decide to do that?

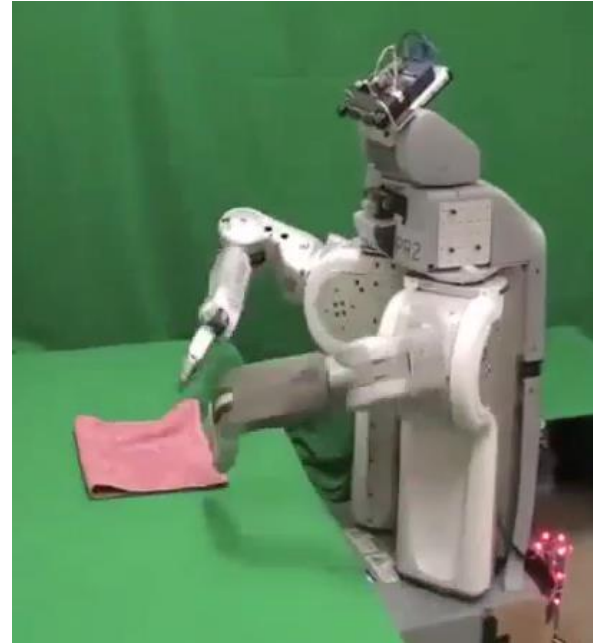


Interacting with AI: Very Open

Clear utility function



Not so clear utility function



AI's Impact

- Applied AI involves many kinds of automation

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

