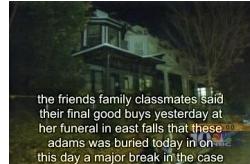


Natural Language

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



Natural Language

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



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

Vision (Perception)

PIXELS -> INFO/DECISION

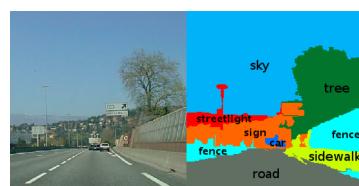
E.g.:

Face detection and recognition



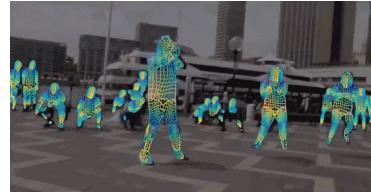
Source: TechCrunch

Semantic Scene Segmentation



[Caesar et al, ECCV 2017]

3-D Understanding

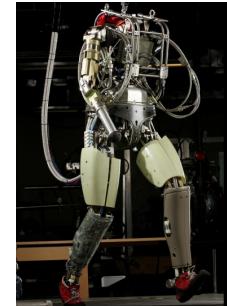


[DensePose]



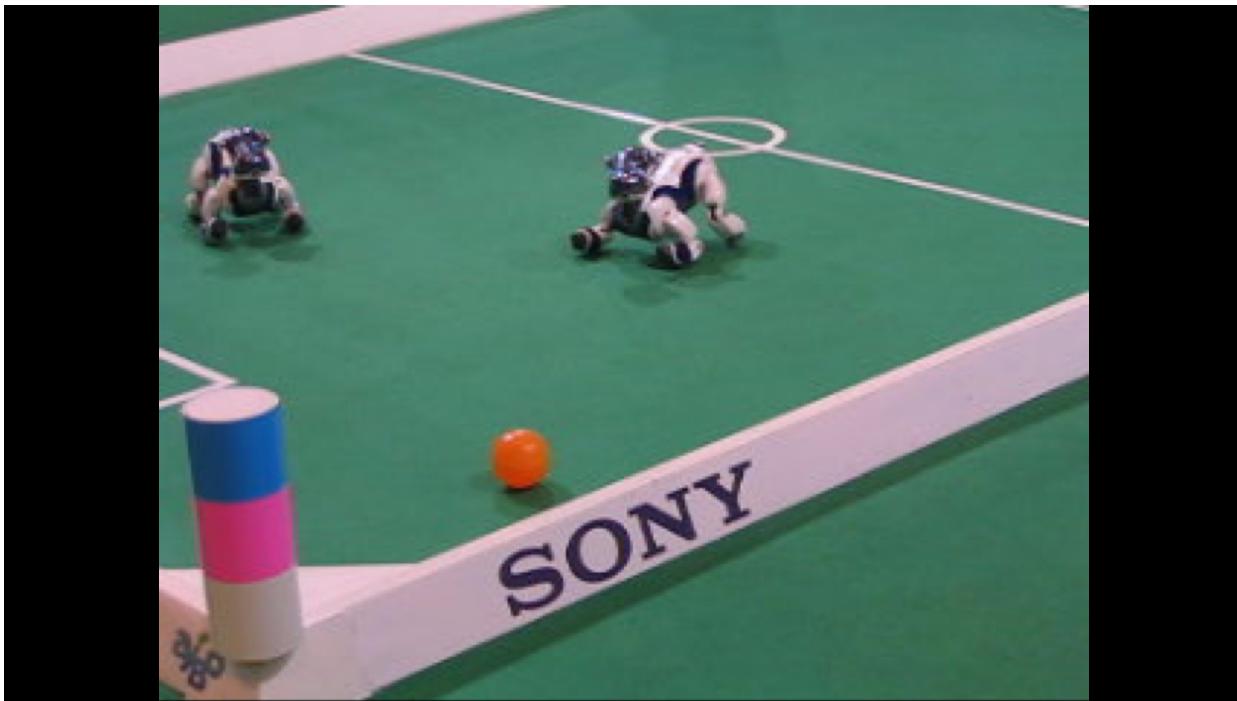
Robotics

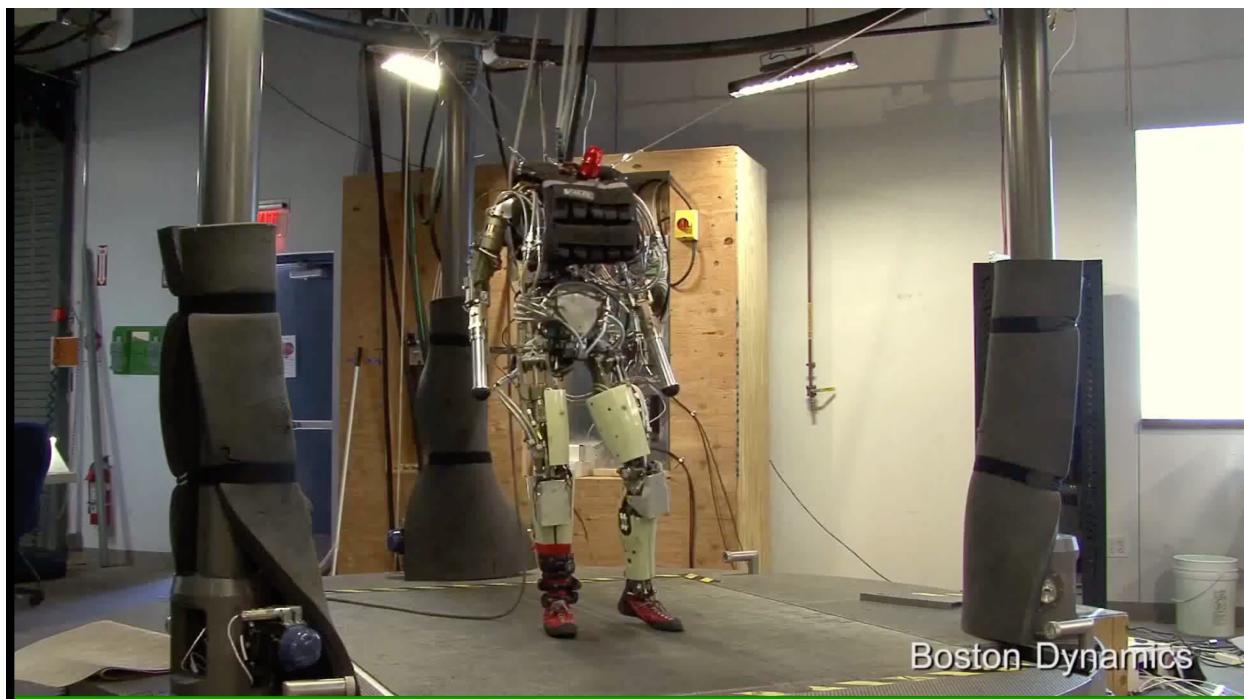
- Robotics
 - Part mech. eng.
 - Part AI
 - Reality much harder than simulations!
- Technologies
 - Vehicles
 - Rescue
 - Soccer!
 - Lots of automation...
- In this class:
 - We ignore mechanical aspects
 - Methods for planning
 - Methods for control



Images from UC Berkeley, RoboCup, Google/Waymo, Boston Dynamics







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 commodity parts
 - 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.”
- **Open question:**
 - How does human cognition deal with the search space explosion of chess?
 - Or: how can humans compete with computers at all??
- **2016: AlphaGo beats Lee Sedol – huge advance: sparse rollouts and self-play**
- **Right now: OpenAI Five vs Team paiN (human pros) -- some caveats!**
 - “[The AI play] was just something like completely different.” Austin Walsh



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

Logic

- **Logical systems**
 - Theorem provers
 - NASA fault diagnosis
 - Question answering
- **Methods:**
 - Deduction systems
 - Constraint satisfaction
 - Satisfiability solvers (huge advances!)

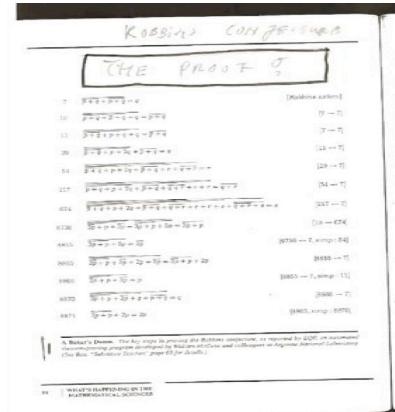


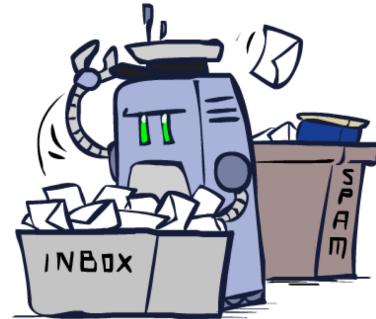
Image from Bart Selman

AI is starting to be everywhere...



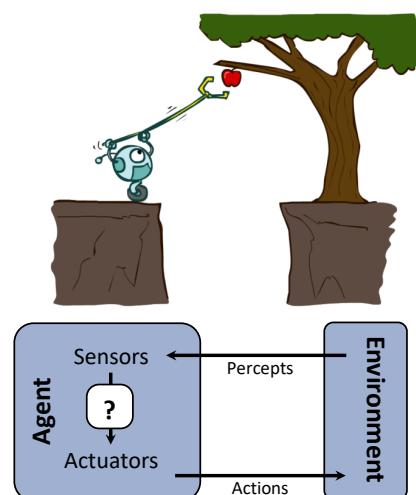
- **Applied AI automates all kinds of things**

- Search engines
- Route planning, e.g. maps, traffic
- Logistics, e.g. packages, inventory
- Medical diagnosis
- Automated help desks
- Spam / fraud detection
- Smarter devices, e.g. cameras
- Product recommendations
- ... Lots more!

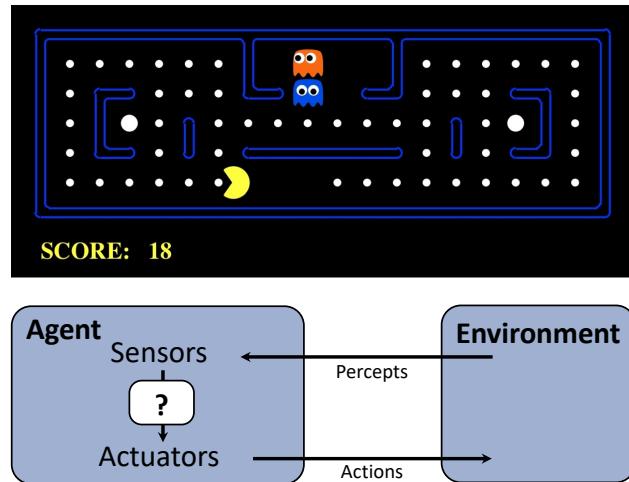


Designing Rational Agents

- 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