

CS 188: Artificial Intelligence

Fall 2011

Lecture 1: Introduction

8/25/2011

Dan Klein – UC Berkeley
Multiple slides over the course adapted from
either Stuart Russell or Andrew Moore

Course Information

<http://inst.cs.berkeley.edu/~cs188>

**CS 188: Artificial Intelligence**
Fall 2011
[Announcements](#) [Course Info](#) [Lectures](#) [Assignments](#) [Section](#) [FAQ](#) [Piazza](#)

Announcements

[8/24/11] The [course calendar](#) is now up.
[8/24/11] Questions? See the [information page](#). The Piazza and staff emails are great places to start.
[8/24/11] Sections begin on 8/30. You are free to sit in any section with space, but have priority in your own.
[8/24/11] P0: [The Python tutorial](#) is posted. It is due Wednesday, 8/31 at 11:59pm (it's short!)
[8/24/11] [Self-diagnostic](#) is up!
[8/23/11] Welcome to CS188! This webpage is currently being updated for the new semester and may contain some outdated information.

- **Communication:**
 - Announcements on webpage
 - Questions? Try the Piazza forum!
 - Staff email: cs188-staff@lists.berkeley.edu
 - This course is webcast

Course Staff

Professor

Dan Klein



GSIs



Mohit
Bansal



Greg
Durrett



Georgia
Gkioxari



Bharath
Hariharan



Woody
Hoburg



Jonathan
Kummerfeld



Jonathan
Long

Course Information

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

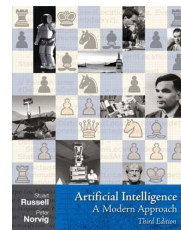
- **Prerequisites:**

- (CS 61A or B) and (Math 55 or CS 70)
- Strongly recommended: CS61A, CS61B and CS70
- **There will be a lot of math and programming**

- **Work and Grading:**

- 5 programming projects: Python, groups of 1-2
 - 5 late days, 2 per project
- 4 written projects: solve together, write-up alone
- Midterm and final
- Participation
- Fixed scale
- Academic integrity policy

- **Contests!**



Today

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

Sci-Fi AI?



What is AI?

The science of making machines that:

Think like humans	Think rationally
Act like humans	Act rationally

Rational Decisions

We'll use the term **rational** in a particular way:

- Rational: maximally achieving pre-defined goals
- Rational 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**

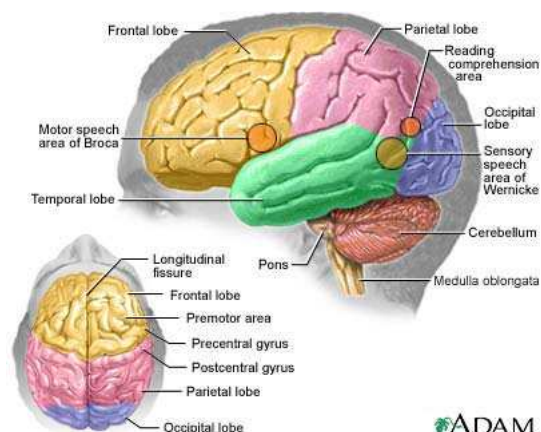
A better title for this course would be:

Computational Rationality

Maximize Your Expected Utility

What About the Brain?

- Brains (human minds) are very good at making rational decisions (but not perfect)
- “Brains are to intelligence as wings are to flight”
- Brains aren’t as modular as software
- Lessons learned: **prediction** and **simulation** are key to decision making



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 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?
- ✗ Converse successfully with another person for an hour?
- ? Perform a complex surgical operation?
- ✓ Put away the dishes and fold the laundry?
- ✓ Translate spoken Chinese into spoken English in real time?
- ✗ Write an intentionally funny story?

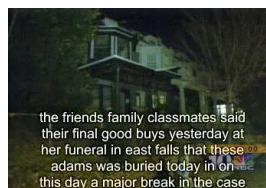
Unintentionally Funny Stories

- One day Joe Bear was hungry. He asked his friend Irving Bird where some honey was. Irving told him there was a beehive in the oak tree. Joe walked to the oak tree. He ate the beehive. The End.
- Henry Squirrel was thirsty. He walked over to the river bank where his good friend Bill Bird was sitting. Henry slipped and fell in the river. Gravity drowned. The End.
- Once upon a time there was a dishonest fox and a vain crow. One day the crow was sitting in his tree, holding a piece of cheese in his mouth. He noticed that he was holding the piece of cheese. He became hungry, and swallowed the cheese. The fox walked over to the crow. The End.

[Shank, Tale-Spin System, 1984]

Natural Language

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



- Information extraction
- Information retrieval, question answering
- Text classification, spam filtering, etc...

[demos: language]

Vision (Perception)

- Object and character recognition
- Scene segmentation
- Image classification

[videos: vision]

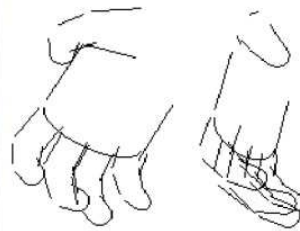
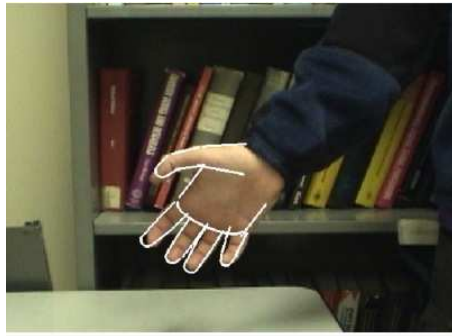
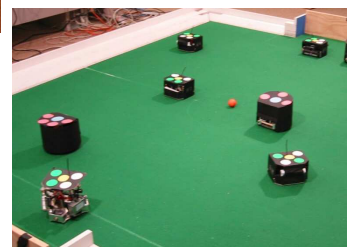


Image from Erik Sudderth

Robotics

[videos: 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 stanfordracing.org, CMU RoboCup, Honda ASIMO sites

Logic

- Logical systems

- Theorem provers
- NASA fault diagnosis
- Question answering

- Methods:

- Deduction systems
- Constraint satisfaction
- Satisfiability solvers (huge advances here!)

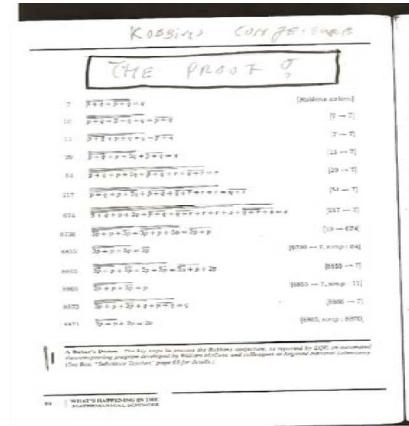


Image from Bart Selman

Game Playing

- 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 big 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."



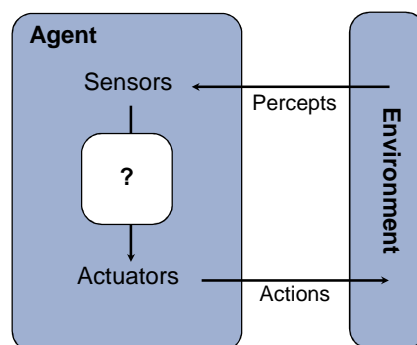
Text from Bart Selman, image from IBM's Deep Blue pages

Decision Making

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

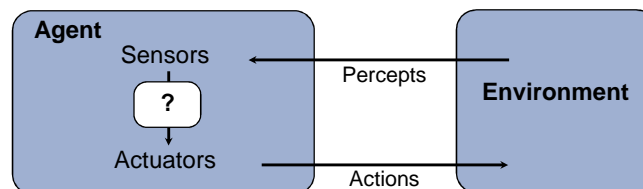
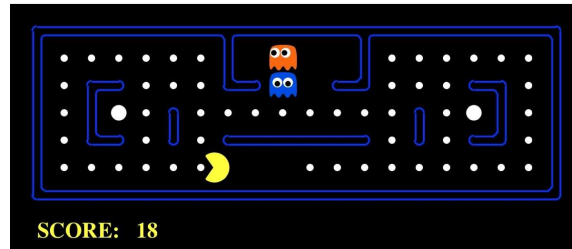
Designing Rational Agents

- An **agent** is an entity that *perceives* and *acts*.
- A **rational agent** selects actions that maximize its **utility function**.
- 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



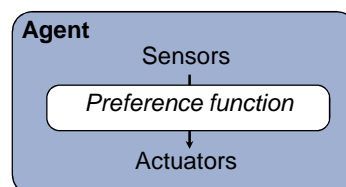
[demo: pacman]

Pacman as an Agent



Reflex Agents

- Consider the present (and maybe past), but not future consequences, to select an action.
- Encode preferences as a function of the percepts and action



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
- **Throughout: Applications**
 - Natural language, vision, robotics, games, ...

Announcements

- **Important this week:**
 - **P0: Python tutorial** is online now (due on Wednesday)
 - **One-time lab hours** this Monday 4-6pm and Wednesday 3pm-5pm in 275 Soda
 - Get your **account forms** in front after class
 - **Self-diagnostic** up on web page
- **Also important:**
 - **Sections** start NEXT week. You may change sections, but you have seating priority where you are registered.
 - The **Waiting list** will take a while to sort out. We don't control enrollment. Contact Michael-David Sasson (msasson@cs) with any questions on the process.

