CIS 471/571: Artificial Intelligence
Fall 2016

Lecture 1: Introduction
9/26/2016

Daniel Lowd
Based on slides by Dan Weld, John DeNero, Dan Klein, Stuart Russell or Andrew Moore

Course Info
Course Website: [http://www.cs.uoregon.edu/Classes/16F/cis471/](http://www.cs.uoregon.edu/Classes/16F/cis471/)
Instructor: Daniel Lowd (lowd@cs.uoregon.edu)
TA: Pedram Rooshenas (pedram@cs.uoregon.edu)
Book: Russell & Norvig, 3rd Edition
(2nd Edition is okay, too.)
Coursework:
- 4 Programming assignments: 40%
- 3 Written homeworks: 30%
- 1 Final exam: 30%
- Grad students: Short survey paper, 15%

3 Websites to watch: Course website, Piazza, and Canvas.

Late Policy
- If you need an extension, ask for one.*
- The earlier you ask, the better. Don’t wait until the last minute.
- I will probably say yes.
- If you abuse this policy, I will start saying no.

* -- Specifically, send email to both lowd@cs.uoregon.edu AND pedram@cs.uoregon.edu

Academic Honesty
Submit your own work:
- Write up homework solutions individually
- Solve programming projects alone (grad students) or in pairs (undergrads)

Follow rules for collaboration:
- No notes (written or electronic) from study groups
- Acknowledge all collaboration

(I have failed students for submitting work that was not their own. It wasn’t fun.)

Today: Introduction and Overview
- What is artificial intelligence?
- What can AI do?
- What is this course?

Sci-Fi AI?
What Can AI Do?

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?
- Buy a week’s worth of groceries on the web?
- Buy a week’s worth of groceries at the Saturday Market?
- 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?

Game Playing

“I could feel – I could smell – a new kind of intelligence across the table”
-Gary Kasparov

Question Answering

Driving

Robotics

Everyday AI?
What is AI?

The science of making machines that:

<table>
<thead>
<tr>
<th>Think link people</th>
<th>Think rationally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act like people</td>
<td>Act rationally</td>
</tr>
</tbody>
</table>

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

An alternate title for this course might be: Computational Rationality

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

- 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, Geometer’s Geometry Engine
  - 1965: Robinson’s complete algorithm for logical reasoning
- 1970—90: Knowledge-based approaches
  - 1969—81: Early development of knowledge-based systems
  - 1980—88: Expert systems industry booms
- 1990—: Statistical approaches
  - Resurgence of probability, focus on uncertainty
  - General increase in technical depth
- 2000—: Where are we now?

Interest in Industry

- IBM Research
- Microsoft Research
- Google Research
- Facebook AI Research (FAIR)
- Baidu Research
- OpenAI (December 2015): $1 billion endowment

Is AI Dangerous?

- “We need to be super careful with AI. Potentially more dangerous than nukes.”
  - Elon Musk, CEO of SpaceX and Tesla Motors
- “Our demise may instead result from the habitat destruction that ensues when the AI begins massive global construction projects using nanotech factories and assemblers—construction.”
  - Nick Bostrom, author of “Superintelligence”
- “There’s a big difference between intelligence and sentience. There could be a race of killer robots in the far future, but I don’t work on not turning AI evil today for the same reason I don’t worry about the problem of overpopulation on the planet Mars.”
  - Andrew Ng, Chief Scientist at Baidu, Prof. at Stanford
Does AI Pose New Risks?

- Are self-driving cars dangerous?
- Are human-driven cars dangerous?
- Are machine-controlled weapons dangerous?
- Are human-controlled weapons dangerous?
- Are humans well-understood?
- Are complex artificial intelligence systems well-understood?

Course Topics

- Part I: Making Decisions
  - Fast search / planning
  - Constraint satisfaction
  - Adversarial and uncertain search

- Part II: Reasoning under Uncertainty
  - Bayesian networks
  - Decision theory
  - Machine learning

- Throughout: Applications
  - Natural language, vision, robotics, games, …

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:
1. General AI techniques for a variety of problem types
2. 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.

Project 0

- Complete a short tutorial on Python
- Answer two simple problems

DUE: Thursday (9/29) @ 10:00pm via Canvas

Project 1: Search

- Goal: Help Pac-Man find his way through a maze
- Methods: Uninformed search (DFS, BFS), heuristic search (A*)
Project 2: Multi-Agent Search

Goal: Play Pac-Man!
Methods: Adversarial search, minimax, expectimax, alpha-beta, etc.

Project 3: Reinforcement Learning

Goal: Help Pac-Man learn about the world
Methods: MDPs, value iteration, reinforcement learning

Project 4: Ghostbusters

Goal: Hunt down invisible ghosts
Methods: Bayesian networks, HMMs, particle filtering

To Do

- Look at the course website: http://www.cs.uoregon.edu/Classes/16F/cis471/
- Do the readings
- Do the Python tutorial (P0)