Introduction to Artificial Intelligence

1/22/18
Administrative Stuff

Course web page:
[cs.swarthmore.edu/~bryce/cs63/s18](cs.swarthmore.edu/~bryce/cs63/s18)

Be sure to check out:
- Readings
- Resources
- “Prerequisites”

Piazza forum:
[piazza.com/swarthmore/spring2018/cs63](piazza.com/swarthmore/spring2018/cs63)

Grading

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<td>Labs</td>
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Office Hours

At some point this semester...
  • you will need help on the labs, and
  • something from lecture won’t make sense.

When this happens, come ask questions.
  • Office hours
    • Mon/Tue 1:30–4:00, Thu 10:00–12:00
    • My door is usually open the rest of the time too.
  • Piazza forum

I have set aside 7 hours every week for office hours. If all you attend is 4 hours of lecture + lab, you will not get the most you can out of this class!
“Prerequisites”

• Linear Algebra
  • Matrix-Vector Multiplication
  • Matrix-Matrix Multiplication
  • Change of Basis

• Multivariable Calculus
  • Partial Derivatives
  • Calculating Gradients
  • Visualizing Gradients

• Probability
  • Disjunction Rule
  • Conjunction Rule
  • Conditional Probability
  • Bayes' Rule

The only actual prereq is CS35.

You may find some of these background videos helpful.
Reading Quizzes

• Readings will be posted at least a week in advance on the course web page.

• You are expected to do the reading before class.

• There will be occasional quizzes on the reading.
A lot has changed in 10 years...

• Watson beat Ken and Brad on Jeopardy:
  • https://www.youtube.com/watch?v=P18EdAKuC1U

• Self-Driving Cars are progressing fast:
  • https://www.youtube.com/watch?v=TsaES--OTzM

• AlphaGo beat Lee Sedol at go:
  • https://www.youtube.com/watch?v=SUbqykXVx0A
What is AI about?

• One goal of studying artificial intelligence is to better understand human intelligence.

• Another goal is to create machines that are as smart as or smarter than humans.

• In practice, AI is about making computers and other machines perform tasks that (for humans) seem to require intelligence.
Some history

“We propose that a two-month, ten man study of artificial intelligence be carried out in the summer of 1956 at Dartmouth College...The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.”

-Dartmouth AI Project Proposal, 1955

“A physical symbol system has the necessary and sufficient means for general intelligent action.”

-Newell and Simon, 1976
Some history

1950s
Perceptron
Neural Nets

1956
Dartmouth
Conference

1958
LISP

1960s
Blocks
World

1972
Prolog

1970s
Expert
Systems

1980s
Probabilistic
Reasoning

1980s
Backprop
Neural Nets

1997
Deep
Blue
vs. Kasparov

2000s-2010s
Widespread
Applications

1990s
Machine
Learning

2000s
Deep
Learning
Nets

2010s
Big
Data

Good old-fashioned AI

AI winter
What is this class about?

**Search**
- An agent’s model of the world includes:
  - its current state
  - goals it wants to achieve
- What actions should the agent take to make progress toward its goals?

route planning, 
game playing

**Learning**
- Given data, such as:
  - sensor readings
  - past action outcomes
- Construct a model of the world or of how to act.

neural networks, 
reinforcement learning
Agents

Entities that make decisions and act.

**Input:**
The world generates observations.

**Output:**
Actions affect the environment.
The Agent Function

We can think of the entire agent, or some portion of it as implementing a function.

A function maps input to output, such as:

- Robot Input: sensor data
- Robot output: motor actions

Sometimes this function directly maps input to output, sometimes there is internal state that affects the mapping.
Modeling

Input to an agent isn’t a complete description of the world. The agent is limited by what it can perceive.

Nowhere near all of what can be perceived can realistically be processed. Some sort of abstraction must take place before agents can make decisions.

An agent needs to build a model from what it can perceive and act based on that model. These are hard problems!
Abstraction happens everywhere

Choosing the right level of abstraction at which to model the world is crucial.