CS 481: Artificial Intelligence

Introduction

Instructor: Marco Alvarez
University of Rhode Island

[These slides were created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley. All materials available at http://ai.berkeley.edu.]

Course Information

- Communication:
  - Announcements on edX edge
  - Questions? Discussion on piazza
  - Videos/Materials: ai.berkeley.edu
  - Office Hours: F 3-4p Tyler 257

- Course technology:
  - Piazza, edge edX
  - Autograded projects, interactive homeworks (unlimited submissions!) + regular homework

- Prerequisites:
  - CSC 301, Python basics
  - Expect a decent load of math and programming

Work and Grading

- 5 programming projects (25% total):
  - Python, groups of 1 or 2
- 10 homework assignments (15% total):
  - 4 are interactive edX homeworks (5% total)
  - 6 are written homeworks graded by real, organic humans (10% total)
  - Submit alone, your own work; may discuss with others

- One in-class midterm (25%), one final (35%)
  - Closed book, 1-page cheat sheet of your own devising
  - Extra credit for contest participation and performance; extraordinary projects
  - Participation can help on margins

- Academic integrity policy

Textbook

- Not required, but for students who want to read more we recommend

Today

- What is artificial intelligence?
  - Past, present, future

- What can AI do?

- What is this course?

Sci-Fi AI?

What is AI?

The science of making machines that:

Think like people
Think rationally

Act like people
Act rationally

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 (Short) History of AI

[Images of historic AI figures and robots]
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: Enthusiasm: Look, Ma, no hands!
  ▪ 1950s: Early AI programs, including Nathaniel Rochester's program "Newell & Sarnoff Logic Theorem". (Detectors' Secretary 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 at Berkeley Bowl?
▪ 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?

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

Vision (Perception)

▪ Object and face recognition
▪ Scene segmentation
▪ Image classification

Robotics

▪ Robotics
  ▪ Part 2: AI
  ▪ Reality much harder than simulations
  ▪ Technologies
  ▪ Vehicles
  ▪ Rescue
  ▪ Soccer
  ▪ Lots of automation...

Logic

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

Game Playing

▪ Classic Moments: May, '97: Deep Blue vs. Kasparov
  ▪ IBM想了两招，最终赢得美资："智能创作"和"智慧"
  ▪ IBM than two, and win the match. More interestingly, the solution is "unpredictable".
  ▪ Kasparov Beats Deep Blue
  ▪ Kasparov Beats Deep Blue
  ▪ Kasparov Beats Deep Blue
  ▪ Kasparov Beats Deep Blue

Decision Making

▪ Applied AI involves many kinds of automation
▪ Scheduling, e.g., airline routing, military
▪ Route planning, e.g., Google maps
▪ Medical diagnosis
▪ Web search engines
▪ Spam classifiers
▪ Automated help desks
▪ Fraud detection
▪ 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

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, …

Pac-Man is a registered trademark of Namco Bandai Games, used here for educational purposes.