CSE 3521: Intro to Artificial Intelligence

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Course Information

Course website: https://lanwuwei.github.io/courses/3521_sp19

Details
Monday, Wednesday and Friday, 10:20am - 11:15am
Place: Cunz Hall 160
Instructor: Wuwei Lan (Office Hours: Monday, Wednesday and Friday, 11:30am - 11:59am)
TA: Chen Liang

Textbook
Stuart Russell and Peter Norvig. *Artificial Intelligence: A Modern Approach (3rd Edition)*, Prentice Hall, 2009.

Berkeley CS 188: https://inst.eecs.berkeley.edu/~cs188/fa18/index.html

Homework and Grading

Grading Policy

- Homework – 20%
- Projects – 30%
- Midterm – 20%
- Final – 30%

Expect 5-6 homework assignments over the course.

Homework submissions are individual, but feel free to discuss.

3 flexible days for project submission, but not for homework.

Academic Misconduct

Discuss all you like, in class and out. However, all work you submit must be your own. If you cheat on a test or copy someone else's code/solutions for homework, you will be reported to the Committee on Academic Misconduct.

Textbook

Not required, but if you want to read more, I recommend

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

- Warning: Not a course textbook, so lectures will not necessarily follow the presentation in the book.

Python

Python Tutorial for Beginners: Learn Programming in 7 Days

Python is an object-oriented programming language created by Guido Rossum in 1989. It is ideally designed for rapid prototyping of complex applications. It has interfaces to many OS system calls and libraries and is extensible to C or C++. Many large companies use the Python programming language include NASA, Google, YouTube, BitTorrent, etc.

Python is widely used in Artificial Intelligence, Natural Language Generation, Neural Networks and other advanced fields of Computer Science. Python had deep focus on code readability & this class will teach you python from basics.

Here is what we cover in the Course

Tutorial	How to Install Python on Windows with Pycharm IDE
Tutorial	Hello World: Creat your First Python Program
Tutorial	Python Main Function with Examples: Understand __main__
Tutorial	Python Variables: Declare, Concatenate, Global & Local
Tutorial	Python Strings: Replace, Join, Split, Reverse, Uppercase & Lowercase
Tutorial	Python TUPLE - Pack, Unpack, Compare, Slicing, Delete, Key
Tutorial	Python Dictionary(Dict): Update, Cmp, Len, Sort, Copy, Items, str Example
Tutorial	Python Operators: Arithmetic, Logical, Comparison, Assignment, Bitwise & Precedence

What is AI?

AI in Culture

The Turing Test

Ingredients:

- Human Judge, unknown Entity
- 2 computer terminals in different rooms

Recipe:

- Have human Judge sit at one computer
- Judge converses with Entity via chat window for 5 minutes
- Judge decides if Entity is human or computer

Which is which?

Left hand side

Judge: Hi what's your name?

Entity: I don't kno

Judge: My name's Jane. I live in London. Wehre do you live

Entity: I live in london aswell

Judge: Do you like living in London?

Entity: yes I like it because there are a lot of things to do there and also it is the capital city of england

Judge: What's my name?

Entity: sorry?

Judge: What's my name?

Entity: jane

Judge: And what's your name?
Entity: I don't know

Right hand side

Judge: What colour is the carpet in your room

Entity: I like pink; what do you like?

Judge: I like pink. My name is John. What's your name?
Entity: Red. Hello John. Its nice to meet such a fine person as yourself.

Judge: Red is my favourite colour. What's yours?

Entity: My favorite color is red.

Judge: You use American spelling. Are you in the USA?

Entity: But you are not even American. Just remember atheism is only a belief system. And it too can be forced on people who don't agree.

Judge: How do you like your eggs – ever easy or sunny side up?
Entity: How I wonder if I like my eggs-over easy or sunny side up? This is so explainable. That list makes me feel unsure John.

Example taken from "Turing's Imitation Game," by Warwick and Shah (2016)

What good is passing the Turing Test?

Chatting “like a human” involves:

- Generating coherent language
- Responding appropriately to unexpected inputs
- …

What isn’t it, though?

The Turing Test does <u>not</u> show

- Understanding or thinking
- Ability to learn
- Interaction with an unconstrained world
- Processing sensory input
- Having knowledge
- Much of anything useful, really

What is AI?

The science of making machines that:

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 better title for this course would be:

Computational Rationality

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 High Street at rush hour?
- ✓ Buy a week's worth of groceries on the web?
- ? 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 Mandarin 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

- Text classification, spam filtering, etc…

Vision (Perception)

- Object and face recognition
- Scene segmentation
- Image classification

Images from Erik Sudderth (left), wikipedia (right)

Demo1: VISION – lec_1_t2_video.flv

Demo2: VISION – lec_1_obj_rec_0.mpg

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, Boston Dynamics, RoboCup, Google

Logic

- Logical systems
  - Theorem provers
  - NASA fault diagnosis
  - Question answering

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

Image from Bart Selman

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 a 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.”

- 2017: AlphaGo beats…well, everyone

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

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!

This Course

Search: How do I (efficiently) find a solution?

Logic and Knowledge: How do I determine what is/isn't known?

Decision Policies: How do I choose the best next action?

Probability: How do I handle dependency and non-determinism?

Machine Learning: How do I learn from past experience?

Philosophy and Ethics: How do I determine what is intelligent? And how do I know that what I'm doing is good?

Next Time

Homework 0 is out now – Due 01/11

Defining rational agents

What are search problems?