Introduction to Artificial Intelligence

CS165A Spring 2022

Instructor: Prof. Yu-Xiang Wang

Lectures: Tuesday and Thursday 12:30 - 1:45 PM at Buchanan 1940

Piazza: `https://piazza.com/ucsb/spring2022/cs165a/home`
(We use Piazza for Q&A, discussion, and most announcement!)

Gradescope: `https://www.gradescope.com/courses/381247`
(We will be using the gradescope for submitting code and project reports.)

Gauchospace: The Gauchospace is active, but it is only reserved for communications that are restricted to people who are officially registered.

1 Overview

Artificial Intelligence is about building and understanding intelligent systems. AI means different things to different people. People have approached the study of AI from various perspectives: philosophy, neurophysiology, mathematics, linguistics, psychology, control systems, and computer science, to name a few. Part of what makes it so interesting is the range of activities, from trying to understand minds in the abstract, to building creatures that run around and do things. AI has made steady progress and contributed to much of what is now standard computer science and cognitive science. It has spawned several sub-areas (e.g., natural language processing, speech recognition, computer vision, robotics, expert systems, and machine learning).

This is an introductory course in artificial intelligence offered as part of a computer science curriculum, so we are not primarily concerned with the approaches of philosophy, cognitive science, etc., although we will come back to them from time to time. We will cover the following technical topics:

- Problem solving and intelligent agents
- Introduction to machine learning (classification)
- Probabilistic modeling and inference (Bayesian networks)
- Problem solving and search (blind, informed, adversarial)
- Introduction to reinforcement learning (Bandits, MDPs and Reinforcement Learning)
- Knowledge Representation and Reasoning (logic)
- Responsible AI (fairness, privacy, AI for social good)

Differences from CS165B: Note that CS165B is about machine learning (ML). In CS165A, we take a broader view of AI and cover a complementary set of topics (each one of them may have a learning component). There isn't a right order in taking these two courses. You can go either way. You will have more ideas on applications of ML for decision making if you have completed CS165A when taking CS165B; meanwhile you will gain deeper understanding in CS165A topics if you have taken CS165B.

2   What you will learn?

By the end of the course, you will understand what AI is all about and what it has contributed, and may contribute, to computing and beyond. You will have a working knowledge of the basic tools of AI, which are applicable to a wide range of problems. You will be able to put yourself in the position of an AI agent and analytically think about how to solve problems in a principled and rational fashion. You will have experience building agents that, to some degree, can perceive their environment, reason about their behavior, and act upon the environment to achieve their goals. You will be able to know where to find more advanced materials and to develop a career in artificial intelligence if you would like to.

This is not primarily a programming course - that is, the main goal is to learn the concepts, not to learn a language or particular programming techniques. However, coding examples of the concepts is the best way to demonstrate (and facilitate) your knowledge of them. Good programming practices (proper file structure, comments, etc.) are expected.

Quite different from a typical CS course, this is perhaps the first course in your curriculum where you will learn how to consolidate what you have learned in mathematics, statistics and coding skills to solve problems. You will get some practices in simple mathematical derivations and translating the mathematical equations into codes in Python / Numpy.

3   Prerequisites

The formal prerequisite is Computer Science 130A (Data Structures and Algorithms I). This implies that you have studied topics such as algorithms, data structures, searching and sorting techniques, recursion, and induction, all of which are relevant to this course. Most importantly, you need to be able to think logically about problems and solution strategies, and you must be familiar enough with writing software to implement solutions on your own. If you have completed the CS pre-major courses (including the Math and PSTAT courses) and CS 130A then you will be very well-prepared.

4   Textbooks

5   Assignments and Grades

The grades will be based on the following breakdowns.

- 45% Coding projects
- 25% Midterm
- 30% Final Exam

6   Coding projects

There will be three coding projects. Each project will take you through the implementation of a particular AI agent we learn in this class. The projects need to be done by each student individually. You will need to submit your code to gradescope and pass the test cases to receive a full score.

7   Optional Homeworks

Homework assignments are *optional* and you will *not* be graded or evaluated on these homeworks. You are however strongly encouraged to attempt the homework questions before attending the

recitations that teach you how they are solved. The homeworks complement the lectures and will allow you to understand the topics more deeply via hands-on practice.

8 Exams

The midterm and final will test your understanding of the materials from the lectures and recitations. They will be easier and shorter than the homeworks.

9 Logistics

Lectures and recitation: The instruction will be in person as per UCSB guideline.

Office hours: Office hours are announced on the course website.

Attendance policy: The attendance to lectures is required and the attendance to recitations is highly recommended.

Late submission policy: Each student has four late days in total.

10 Policy on Academic Integrity

Please read this section carefully.

The university, the department, and this instructor all take the issue of academic integrity **very** seriously. A university requires an atmosphere of mutual trust and respect. While collaboration is an integral part of many scholarly activities, it is not always appropriate in a course, and it is never appropriate unless due credit is given to all participants in the collaboration.

Here are some examples:

- Allowed: Discussion of lecture and textbook materials

- Allowed: Discussion of how to approach assignments, what techniques to consider, what textbook or lecture material is relevant

- Allowed: Collaboration on coding projects. You need to declare your collaborators, and describe what you get from the person who helped you, and each student still needs to write their own report / code independently.

- Allowed: Refer to online resources, but you need to cite the exact references.

- Not allowed: Turning in someone else's work as your own, even with that person's permission.

- Not allowed: Allowing someone else to turn in your work as his or her own.

- Not allowed: Turning in work without proper acknowledgment of the sources of the content (including ideas) contained within the work.

For some views on academic integrity at UCSB see the Academic Integrity page of the Office of Judicial Affairs.

Summary: Academic integrity is absolutely required - dishonesty (cheating, plagiarism, etc.) benefits no one and hurts everyone. Violations of these honor codes on academic integrity will be reported to the Office of Student Conduct. If you find yourself in such a situation, please contact the instructor. If you are not sure whether or not something is appropriate, please ask the instructor.

11   Code of conduct

The University of California, Santa Barbara has a general code of conduct for all students published here: `http://www.sa.ucsb.edu/docs/default-source/student-conduct/conductofcode2017.pdf?sfvrsn=d3c07d4f_2`

The computer science department's commitment to Diversity, Equity and Inclusion is published here: `https://cs.ucsb.edu/content/diversity-equity-and-inclusion`.

As a department, we holds students, staff, and faculty to the following standards:

- Treat all members of the academic community (students, staff, and faculty) with respect regardless of their experiences and background, including (but not limited to) their cultural backgrounds, socioeconomic status, disabilities, age, religion, sexual orientation, neuro(a)typicality, and gender identity.

- Physical or mental harm, sexual harassment, aggression, and derogatory language is not acceptable in any form.

- Respect the personal property of others and University resources. Unauthorized access, use, vandalism, or theft of equipment, computer servers, labs / offices / classrooms, etc. is prohibited.

- The exchange and challenge of ideas are done in a thoughtful, respectful and constructive manner.

- Disruption of departmental activities such as special events, talks, lectures, and meetings is not acceptable.

- Any violation of the given standards should be reported to the Computer Science chair and/or the CS diversity committee (`diversity@cs.ucsb.edu`). Consequences may include a formal warning, suspension, or expulsion from the University.

12   Students with Disabilities

If you are a student with a disability and would like to discuss special academic accommodations, please contact the instructor. In addition, students with temporary or permanent disabilities are referred to the Disabled Students Program (DSP) at UCSB. DSP will arrange for special services when appropriate (e.g., facilitation of access, note takers, readers, sign language interpreters). Please note that it is the student's responsibility to communicate his or her special needs to the instructor, along with a letter of verification from DSP.

13   Copyright of course materials

My lectures and course materials, including presentations slides, written notes, recorded lectures, homework assignments and similar materials, are protected by U.S. copyright law and by University policy. I am the exclusive owner of the copyright in those materials I create. You may take notes and make copies of course materials for your own use. You may also share those materials with another student who is enrolled in or auditing this course. You may not reproduce, distribute or display (post/upload) lecture notes or recordings or course materials in any other way — whether or not a fee is charged — without my express prior written consent. You also may not allow others to do so.

If you do so, you may be subject to student conduct proceedings under the UC Santa Barbara Student Code of Conduct.