CSE 150A Introduction to AI: Probabilistic Reasoning and Decision-Making

Summer 2023

About the Course

Course Description

This course will introduce students to the probabilistic and statistical models at the heart of modern artificial intelligence. Specific topics to be covered include: probabilistic methods for reasoning and decision-making under uncertainty; inference and learning in Bayesian networks; prediction and planning in Markov decision processes; applications to intelligent systems, speech and natural language processing, information retrieval, and robotics.

Prerequisites

This course is aimed very broadly at undergraduates in mathematics, science, and engineering. Prerequisites are elementary probability, linear algebra, and calculus, as well as basic programming ability in some high-level language such as C, Java, Matlab, R, or Python. (Programming assignments are completed in the language of the student's choice, although we recommend Python.) Students of all backgrounds are welcome.

Learning Outcomes

Upon successful completion of this course, students will be able to:
- Describe the structure and behavior of different probabilistic models including Bayes Nets, Hidden Markov Models, and Markov Decision Processes.
- Perform inference on those models, to derive various quantities from the model parameters.
- Prove mathematical relationships between probabilities arising from these models.
- Perform learning on those models, to estimate the various parameters from data.
- Apply probabilistic models to solve real-world problems.
- Design specific models for specific AI tasks.
- Implement core algorithms of different models.
- Describe how agents learn from data using maximum likelihood learning and reinforcement learning.

Course Logistics

Instructor and Course Staff

Instructor: Mary Anne Smart, CSE 4142, msmart@ucsd.edu (Feel free to call me Mary Anne!)

OH: TBD

TA: Rishikanth Chandrasekaran, r3chandr@ucsd.edu

OH: TBD

Tutors:

- Aaron Liu, aal006@ucsd.edu

    OH: TBD

- Weiyue Li, wel019@ucsd.edu

Please use Piazza/Discord for all course-related questions. (We will vote on whether to use Piazza or Discord, and I will update the syllabus accordingly after the vote.) Use email only when you need to reach a specific staff member to speak to them personally. Please use the following form to share any anonymous feedback: https://tinyurl.com/cse150a

All of the course staff will have weekly office hours. The days, times and locations of the office hours will be listed on the course site. If you cannot make it to these times and are unable to get your questions answered on Piazza/Discord, or you have a personal matter to discuss with the instructor, please send the instructor an email to set up an appointment to meet.

Course Resources

Books

There are **no required textbooks** for this course. The recommended textbooks are:
- *Artificial Intelligence: Foundations of Computational Agents,* 2nd ed. by Poole and Mackworth. An online version of this textbook can be found on the publisher's website: https://artint.info/2e/html/ArtInt2e.html
- Artificial Intelligence: A Modern Approach, 3rd ed by Russell and Norvig. I have asked that a copy of this book be placed on reserve at Geisel library

I will do my best to point you to other open resources that will be useful throughout the quarter.

Websites

Canvas: https://canvas.ucsd.edu/courses/47968
Check this page for schedule information, office hours, and assignments, reflections, and cumulative grades.

Gradescope: https://www.gradescope.com/courses/554105
Homework will be submitted, graded, and regraded via gradescope. Homework is generally due Fridays at 11:59pm

Piazza/Discord: TBA
All course-related questions should be asked through Piazza/Discord. Announcements will be posted to Piazza/Discord and/or Canvas.

Public-facing course website: https://msmart14.github.io/cse-150a-summer23/

Time and Location

Class meets M/Tu/W/Th, 2:00pm-3:20pm in WLH 2111. Attendance in class is strongly encouraged, but please stay home if you are sick. Slides/notes will be posted, and classes will be podcast (but no guarantee on podcast quality is offered).

Discussion sections meet on Tu/Th from 3:30p-4:20p. Short quizzes will be given at the start of Tuesday discussion sections, with the exception of the first quiz, which will be given on Thursday.

Coursework and Grades

Assignments/Coursework

Homework assignments (HW)

Approximately each week you will have a homework assignment to complete. These assignments will consist of a combination of written work (proofs and mathematical exercises) and short programs to write. All assignments will be submitted via Gradescope. You can find the link to our gradescope page above.

The last homework assignment will likely be a small open-ended mini-project. More details on that will be given later in the quarter.

Homework assignments are generally due at 11:59pm on Fridays. We understand that things happen and that you may sometimes need an extra day to complete an assignment. However, if you are regularly turning in assignments late, we may have a conversation. No late assignments will be accepted after 12:00pm on Mondays. Your lowest homework score will be dropped.

Reflection Questions

This class will use write-to-learn reflections, approximately one per week, typically due Thursdays at 11:59pm. This assignment will involve responding to a short prompt and reflecting on your learning or tying different concepts together. These assignments will be short and should take no more than 15 minutes to complete. However, for credit it must be clear that you have taken the reflection seriously and have put thought into your response. Your lowest score will be dropped when calculating your final grade.

Quizzes

Quizzes will be given weekly at the start of each Tuesday discussion section. These quizzes will usually consist of a single problem taken directly from the most recently submitted homework assignment. The numbers might be changed slightly, but if you did the homework problem successfully, you should have no problem with the quiz. Your lowest quiz score will be dropped when calculating your final grade.

Exams

There will be one midterm exam and one final exam. The midterm will be a take-home exam, and the final exam will be during the scheduled exam time visible on the schedule of classes, 3:00pm-5:59pm on Friday, August 4th. The location of the final is TBA. If you perform better on the final exam than on the midterm, your midterm score will be dropped, and your final exam score will be re-weighted as 60% of your grade. In other words, the midterm can only help your final grade.

Grading

- Homework: 25% (lowest score dropped)
- Midterm: 25% (dropped if performance is better on the final)
- Quizzes: 10% (lowest score dropped)
- Reflection questions on Canvas: 5% (lowest score dropped)
- Final: 35%

Course Policies

Academic Integrity

In this course we expect students to adhere to the [UC San Diego Integrity of Scholarship Policy](). This means that you will complete your work honestly, with integrity, and support and environment of integrity within the class for which you are tutoring. Some examples of specific ways this policy applies to CSE 150 include:

- Collaboration is allowed during homework assignments, but all writeups must be completed individually.
- Students may not post any problems or solutions from any homework or exam to any repository or website.
- No unauthorized aids may be used during quizzes or exams.

Collaboration Policy

We strongly encourage collaboration (but NOT copying) on the homework assignments. You may talk to anyone in the course about how to solve the problems, and you may even compare your solutions. However, you must write up your solutions yourself, and you **may not copy**. The write-up that you turn in must reflect your own understanding.

Quizzes and exams are closed book and closed notes, with the exception of the midterm exam. We may allow you to use a handwritten sheet of notes on the exams (but not the quizzes). If this is allowed, more information will be given at exam time. Use of unauthorized aids is strictly prohibited.

You may not discuss quiz or exam problems with *anyone* until after the exam or quiz has been graded and returned to you.

Regrade Policy

Regrades must be requested through Gradescope within two days of the homework assignment being graded and returned to you. It is possible for your grade to decrease if a mistake is discovered during the regrade that would cost you points.

Late or Missed Assignments/Missed Exam Policy

Late homework will not be accepted after 12:00pm on Mondays. Exams and quizzes must be taken at their scheduled time and, generally speaking, may not be made up—if you are sick or are in an emergency, please talk to the instructor about it as soon as possible.

Technology Policy

Technology should be used in class only when its use directly supports the activity/learning that a student is engaged in. Students may use devices to access slides or websites, calculate values, access review problems, etc, as it aligns with course content. Use of technology for any activity not directly related to what is going on in class is discouraged.

Resources for Students

Getting Help

We expect that all students will need help at some point during the quarter. Many resources are available including TA and instructor office hours, as well as the Piazza/Discord discussion board. We also encourage you to form study groups, but make sure that you adhere to the collaboration policy listed above in this syllabus.

The IDEA Engineering Student Center, located just off the lobby of Jacobs Hall, is a hub for student engagement, academic enrichment, personal/professional development, leadership, community involvement, and a respectful learning environment for all. The IDEA Center programs support both undergraduate students and graduate students."

Diversity and Inclusion

We are committed to fostering a learning environment for this course that supports a diversity of thoughts, perspectives and experiences, and respects your identities (including race, ethnicity, heritage, gender, sex, class, sexuality, religion, ability, age, educational background, etc.). Our goal is to create a diverse and inclusive learning environment where all students feel comfortable and can thrive.

Our instructional staff will make a concerted effort to be welcoming and inclusive to the wide diversity of students in this course. If there is a way we can make you feel more included please let one of the course staff know, either in person or via email/discussion board. Our learning about diverse perspectives and identities is an ongoing process, and we welcome your perspectives and input.

We also expect that you, as a student in this course, will honor and respect your classmates, abiding by the UCSD Principles of Community. Please understand that others' backgrounds,

perspectives and experiences may be different from your own, and help us to build an environment where everyone is respected and feels comfortable. If you experience any sort of harassment or discrimination, please contact the instructor as soon as possible. If you prefer to speak with someone outside of the course, please contact the [Office of Prevention of Harassment and Discrimination](#).

Students with Disabilities

We aim to create an environment in which all students can succeed in this course. If you have a disability, please contact the [Office for Students with Disability (OSD)](#), which is located in Pepper Canyon Hall Suite 300, to discuss appropriate accommodations right away. We will work to provide you with the accommodations you need, but please provide a current Authorization for Accommodation (AFA) letter issued by the OSD. You are requested to present their AFA letters to faculty (please make arrangements to contact me privately) and to the OSD Liaison (cse-osd@ucsd.edu) in the department in advance so that accommodations may be arranged. Let us know if you have suggestions for how to make this class more accessible.

Basic Needs

There are resources available on campus to help with basic needs (food, housing, financial resources), including [The Hub](#) and the [Triton Food Pantry](#). Additional resources are listed on the [instructor's website](#).

This syllabus was adapted from a prior syllabus from Dr. Joseph Geumlek.