CSCI 3202: Introduction to Artificial Intelligence

Description: Surveys artificial intelligence techniques of search, knowledge representation and reasoning, probabilistic inference, machine learning, and natural language processing. Introduces artificial intelligence programming. Requires prereq courses of CSCI 2270 & CSCI 2824 or MATH 2001 or ECEN 2703 or APPM 3170 & one of the following Prob/Stats courses: APPM 3570,4570,4520, CSCI 3022, MATH 3510,4510, CVEN 3227, CHEN 3010, ECEN 3810, MCEN 4120 or ECON 3818 (all min grade C-).

Learning goal: An understanding of the issues involved in building computer systems that behave rationally. The ability to design and implement standard algorithms for heuristic search, logical reasoning, probabilistic inference, and machine learning for various engineering applications. The ability to evaluate the performance of these algorithms on realistic datasets.

Google Calendar: Click this link and add the Calendar to yours; it may only be accessed from your `colorado.edu` Google account.

Meeting times: Mondays, Wednesdays, and Fridays at 10:20–11:10a, via Zoom.

Instructors: Christoffer Heckman (`christoffer.heckman@colorado.edu`) and
Sriram Sankaranarayanan (`srirams@colorado.edu`).

Office hours: Check the course Google Calendar, above for links and times.

Teaching Assistant: Emily Jensen (`emily.jensen@colorado.edu`).

Course Manager: Jaeyoung Oh (`jaeyoung.oh@colorado.edu`).

Course Assistants: Alex Book (`alex.book@colorado.edu`),
Everett Kirkpatrick (`everett.kirkpatrick@colorado.edu`), and
Konlan Rondini (`konlan.rondini@colorado.edu`)

Graders: Tavishi Priyam (`Tavishi.Priyam@colorado.edu`) and
Nischal Paramashivaiah (`nischal.paramashivaiah@colorado.edu`).

Textbook: Artificial Intelligence: A Modern Approach (3rd Edition) by Russell & Norvig. Electronic, old and international editions are fine, but you are responsible for making the mapping between relevant sections if the numbering is off.

Topics:

- Search algorithms and heuristics: Survey of modern search algorithms through a discrete data set to find an optimal solution. Methods for designing heuristic methods that can be used to find approximate solutions to problems. Global search techniques.

- Games: Search methods when there are two players with conflicting objects influencing the search space.

- Markov decision processes: Algorithms for navigating a search space given a set of rules and current state, and how these algorithms can be applied to accomplish a task.

- Statistical inference: Introduction to Bayesian reasoning and calculating the probability of outcomes of a random process, variably under certain conditions. Bayesian networks, probabilistic reasoning, and Hidden Markov models.

- Machine learning: Grouping data into discrete classes using the observed properties of the data (classification). Using data to estimate the value of a random function (regression). Feature engineering and discrete and continuous function representation. Examples from computer vision and natural language processing.

- Applications of AI methods: Self-driving vehicles and medical devices. Intelligent agents and dialogue systems. Ethical implications, especially of data-driven techniques.

Grading: Your grade will be determined by the following breakdown:

Weekly Assignments: 30%.

Weekly Quizlets: 10%.

Spot Exams: 30%

Final Exam: 20%.

Mini-Projects: 10%

Quizlets: Quizlets are multiple choice questions on Canvas posted each week. These exercises will build on examples and concepts reviewed in class. Your lowest quiz score will be dropped. No late submissions will be accepted unless there is an unforeseen medical/personal emergency.

Weekly Assignments: Assignments will be assigned roughly every week throughout the course, except when an exam or project is assigned.

You may discuss assignments with your classmates, but all work must be your own. Copying solutions or code snippets from the Internet/others constitutes academic dishonesty and is unacceptable, even with proper citation (that work is not your own). See the Collaboration Policy below for more details. Assignments are due by 11:59pm on the listed due date. Your lowest homework score will be dropped. Assignments will be submitted electronically through Canvas. Hard-copy submissions and emailed submissions will not be accepted. No late submissions will be accepted unless there is an unforeseen medical/personal emergency.

Spot Exams: There will be multiple spot exams administered throughout the semester. These exams will cover roughly 3–4 weeks of material, and will last 30 minutes each. The exam will be held online and can be taken by the student during a time window (typically Fridays 12–6 pm). Dates for the exams will be announced 2 weeks in advance. We will drop your lowest score from these exams.

Final Exam: There will also be one exam during the scheduled Final Exam time as designated by the campus. We will publish the detailed times and syllabi for the final as it approaches.

Mini Projects: There will be 2 or 3 mini projects that will involve developing part of an AI application. Mini projects will be given out over 2–3 week periods and will involve some open ended portions for the student to explore new ideas and engage deeper with the material.

Python: All programming assignments will be written in Python 3 in Jupyter notebooks, and all Assignments will be graded using an auto-grading script. If you're not familiar with Python or Jupyter notebooks, embrace this requirement as a chance to learn a new language. This language and tools connected to it are ubiquitous in the fields of AI/ML/data science.

Canvas and other technologies: We will use Canvas for quizlets, submitting homework assignments electronically and as a gradebook. You must be enrolled in the course in order to be

We will use Piazza for class discussion and management. The system is highly catered to getting you help efficiently from classmates, the grader and the instructor. Rather than emailing me questions, I request that you to post your questions on Piazza. If your question is of a private nature, Piazza allows you to send private messages to the instructors. It is your responsibility to check the web page on a regular basis. Here you will find detailed information such as news, homework and solutions, and instructor office hours. To sign up for the Piazza, click this link.

Finally, please enroll in the course Google Calendar for notice of lecture topics, office hours, assignment issue/due dates, and out-of-office notices from me. The link to the calendar is on the first page of this syllabus.
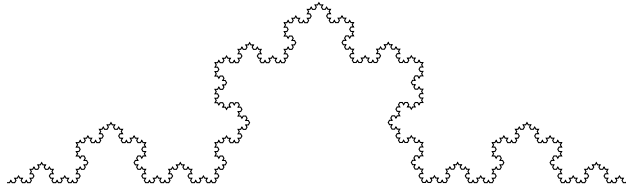
Collaboration Policy: You are encouraged to work together on assignments (except the practicum). But all work you submit must be your own.

The internet is useful to figure out how to manipulate code in certain ways and solve smaller components of a larger problem. Looking things up is okay! But copy-pasting codes is not okay—that work is not your own. **This includes even just snippets of code.**

Copying codes/solutions from sites like StackExchange and Chegg is unacceptable and will result in an F on that Assignment, quizlet or the practicum.

That seems simple, but it is worth unpacking what this means. Here are some examples.

> Oh no! Grace forgot how to slice arrays in Python! She looks this up on the internet, and incorporates it into her codes for a programming assignment. Does this violate the Collaboration Policy?

No—Grace only looked to fill gaps in her basic programming knowledge. This differs from searching for a full solution online in that Grace is still tackling the problem-solving aspects of the assignment on her own.

> Chris and Rhonda are working together on some code, but stuck on some particular part of the function they need to write. They work together in CSEL, where they sketch out a solution on a whiteboard. Later, they each code up the solution on their own. Does this violate the Collaboration Policy?

No—they each did their own work, so they are collaborating correctly.

> Maciej later walks into CSEL and sees still on the whiteboard the solution to this problem that Chris and Rhonda worked out. He snaps a photo of it with his phone, and later codes it up with some modification.

This violates the Collaboration Policy because Maciej did not contribute in any meaningful way to that solution; it is not his work. Renaming variables and changing a "for" loop to a "while" loop does not change the fact that Maciej has violated the Collaboration Policy.

The consequences of copying solutions from StackExchange and Chegg (e.g.) are the same.

Any discovered incidents of violation of this Collaboration Policy will be treated as violations of the University's Academic Integrity Policy and will lead to an automatic academic sanction in the course and a report to both the College of Engineering and Applied Science and the Honor Code Council.

Collaboration boundaries are hard to define crisply, and may differ from class to class. If you are in any doubt about where they lie for a particular course, it is your responsibility to ask the course instructor.

Disability Accommodations: If you qualify for accommodations because of a disability, please submit to your instructor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu. If you have a temporary medical condition or injury, see the Temporary

Injuries guidelines under the Quick Links at the Disability Services website and discuss your needs with your instructor.

Religious Observances: Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. In this class, all students are permitted four absences without any affect on their attendance grade, for any reason including religious accommodation. See the campus policy regarding religious observances for full details.

Classroom Behavior Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the student code.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation: The University of Colorado Boulder (CU Boulder) is committed to maintaining a positive learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CU's Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU Boulder's Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at the OIEC website.

Honor Code: All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the academic integrity policy of the institution. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code Council as well as academic sanctions from the faculty member. Additional information regarding the academic integrity policy can be found at honorcode.colorado.edu.