CSPB 3702 - Reckwerdt - Cognitive Science

CSPB 3702 Syllabus

CSPB 3702 - Cognitive Science – Spring 2023

Instructor Information

Name: Eric Reckwerdt (he/him)
Office Hours: Tuesdays 1-2, Wednesdays 7-8
All times listed are Mountain Time unless otherwise noted.
Zoom and Piazza link: Available the first week of class on the course webpage
Contact: eric.reckwerdt@colorado.edu

Course Information

Course description and purpose

This course examines the ways in which our current understanding of human thinking is both illuminated and challenged by the evolving techniques and ideas of artificial intelligence and computer science. Our collective understanding of "minds" – both biological and computational - has been revolutionized over the past half century by themes originating in fields like cognitive psychology, machine learning, neuroscience, evolutionary psychology, and game theory, among others. This course will focus on both the larger "historical" arc of these changes, as well as current research directions and controversies.

Requirements

There are no specific prerequisites to the course, though (as an online course) it is intended primarily for students with confidence in their ability for independent study.

Format

This course will operate as a "flipped classroom". The primary course materials will consist of online lectures augmented by problem sets, readings, and links to additional materials of interest on the Web. Additionally, each week we will have a moderated class discussion on the course topics of the previous week.

Learning Goals & Expectations

By the end of this course the student will be able to:
CO1: Discuss strengths and weaknesses of different interpretations of artificial minds.
CO2: Outline computational models of problem solving
CO3: Articulate the purposes and benefits of different forms of heuristic reasoning.
CO4: Capture the boundaries and shortcomings of various models of human vision.
CO5: Explain the implications of various models and experiments to our understanding of mental imagery...
CO6: Explain and demonstrate the expected outcomes for various game theory scenarios.
CO7: Discuss various aspects and implications of evolutionary and developmental psychology.
CO8: Discover and synthesize research in multiple areas of cognitive science.

Textbooks & Materials

There is no required textbook for this course. Reading material will be available on the course website.

Assignments

Assignments include reading quizzes, , class discussions, and projects. Grades will be available through the Moodle gradebook. Individual item grades contained in that gradebook are considered authoritative - please use the contact information in this syllabus to discuss any gradebook concerns. Any grade change requests must be made within one week of an assignment being returned. By resubmitting your work you understand

that all problems and aspects may be regraded regardless of whether it is to your advantage or not.

Weekly Discussions (20% of grade)

Discussions will take place on Piazza, (see link above). On Piazza, there are folders set up as tags for each week of the course, which will contain weekly update announcements and discussion threads for **EACH** week. This is an important and required component of the course. **You are required to make at least 5 posts a week for full credit**:

- You may posts to multiple threads but some posts must be in response to others' comments.
- Posts should be non-trivial and must usually consist of a least 2 - 3 well formed sentences (and will often be longer).
- Weekly Posts are due every FRIDAY - although I will not check them until Monday.
- Post must not all come on the final day/hour.
- Effective discussions require daily or ongoing attention, using the folders and threads, and READING the discussion thread instructions.
- Trivial, last minute, or sloppy posts may not be counted for credit - we will drop one weekly discussion grade.
- Our goal is to curate lively and engaging discussion - not be Piazza police.
- We will do our best to grade fairly, graders decisions will be final.

Weekly Quizzes (40% of grade)

Quizzes, based on the readings, lectures, and some additional research will usually be weekly. You will have 2 attempts at each quiz. The first attempt will show which questions were answered correctly. The next attempt will be final. Some items will be hand graded after the final quiz attempt is submitted. See the practice quiz. The lowest quiz score will be dropped.

Module Projects (40% of grade)

Mini-Projects (5) - Roughly, each module will have a mini-project which will explore computer science applications of cognitive science. Please pay attention the due dates:
- Project 1: Friday September 15th
- Project 2: Friday March 1st
- Project 3: Friday November 3rd
- Project 4: Friday December 1st
- Project 5: Thursday December 14th

Late Assignment Policy

No late work is accepted.

(Module 1A)

1.1 The Lure, and Eeriness, of Machine Life. How living things, and mechanical things, seem to act as metaphors for each other.
1.2 The Turing Test. The classic (and much-debated) test of artificial intelligence.
1.3 The Computational Metaphor of Mind. Mind as software.

(Module 1B)

1.4 What Makes a Problem Hard? Thinking of cognitive problems in computational terms.

1.5 What Makes a Problem Hard? Thinking of cognitive problems in computational terms. Part 2
1.6 What Makes a Problem Hard? Thinking of cognitive problems in computational terms. Part 3

(Module 2A)

2.1 Solving Problems. Thinking of problems/puzzles as tasks for computer programs.
2.2 Problems for Minds and Machines. Search vs. human problem-solving.
2.3 Hard Problems for Computers. Problems beyond the "search" paradigm.

(Module 2B)

2.4 Machines and Logic. Logic in machine reasoning.

2.5 Judgment and Decision-Making. "Judgment" vs. "problem-solving".

2.6 Heuristics and Biases in Judgment. Classic issues in judgment and decision-making.

(Module 3A)

3.1 Vision as a Computational Problem. Why is vision hard?

3.2 Finding Edges. The computational approach to a fundamental problem of low-level vision.

(Module 3B)

3.3 Depth Perception. Computational (and human) techniques for determining distance

3.4 Object Recognition. How do we (and computers) identify objects?

(Module 3C/D)

3.5 Mental imagery and the brain. A brief introduction to the "imagery debate" and how it has been (more or less) resolved by brain science.

3.6 Mental imagery and the "turn towards Neuroscience"

Problem Set 6 assigned

3.7 Neural Networks and Perceptrons

3.8 Multi-layer Neural Networks

3.9 Deep Learning: Object Recognition

(Module 4A)

4.1 Game Theory as a Model of Decision Making Beyond the Individual. An introduction to the basic terminology of game theory.

4.2 The Prisoner's Dilemma and the Origins of Cooperation. A classic non-zero game and how it illuminates the ways in which cooperation can develop over time.

(Module 4B)

4.3 Game Theory: Axelrod's Tournament

4.4 Games "in the large". How do large groups behave?

(Module 5A)

5.1 Game Theory & Evolution

5.2 Evolutionary game theory. How "game strategies" evolve in animals; genetic algorithms in machines.

(Module 5B)

5.3 Infant & Child cognition. What can we learn about thinking from the problems that infants solve?

5.4 Embodied Cognition.

5.5 Artificial Life. Creating "animals" using the techniques of robotics

Grading

The final grades for this class follow the standard percentage breakdown for the College of Engineering:

Percentage	Letter Grade
>=93.0%	A
>=90% & <93%	A-
>=87% & <90%	B+
>=83% & <87%	B
>=80% & <83%	B-
>=77% & <80%	C+
>=73% & <77%	C
>=70% & <73%	C-
>=67% & <70%	D+
>=63% & <67%	D
>=60% & <63%	D-
<60%	F

Policies & University Statements

Individual Check-In

If you have a unique situation that may be affecting your work or class experience -or- you need clarification of an email, Piazza, or ZOOM exchange, please email your instructor with the subject line "Individual Check-In". Your instructor will email you back to set up a Zoom call to discuss the specific situation and work with you to develop a solution and/or strategy to move forward.

Service Interruptions and Support

Due to the online nature of the program, there is always the possibility of service interruptions. If you are unable to access the course materials (Moodle, Piazza, etc), we encourage you to visit **https://www.isitdownrightnow.com/applied.cs.colorado.edu.html**

For non-urgent issues relating to platform support, please contact cscihelp@colorado.edu.
For urgent issues, for example, attempting to upload a homework assignment near a deadline, email your instructor directly.
In cases of documented exceptional illness or circumstances affecting assignments, instructors may or may not offer an alternative assessment (which may differ in form or content) at the instructor's discretion. Please consult the campus policy for medical leave if needed.

Collaboration Policy

We welcome collaboration! Sharing insights, asking questions, learning by doing, and learning by helping others are essential skills in learning computer science.
Collaboration is discussing ideas of the course with others, sharing insights and extra resources, working through similar questions to an assignment, sharing resources, and helping others. The Piazza forum in your class is an ideal place to share ideas, lead a discussion or be the hero that asks the "dumb question" everyone else is afraid to ask. And Piazza is often a source for content for instructors to include in letters of recommendations. Your leadership, courage, and determination will not go unnoticed.
Collaboration is not:

- "Having a partner." In particular, Group Projects, or projects that specify "working with a partner" will have individual guidelines.

- One student solving problems 1-4, and another solving 6-10.

- An identical group solution submitted by multiple students.

Unless specified in the assignment, all submitted coursework is individual.
In general:

- You must document resources and collaboration on any assignment. This should be in the form of comments at the start of code and/or within solution notes.

- Cite Your Sources: If you collaborated with someone on an assignment, or if your submission includes quotes from a book, a paper, or a web site, you must clearly acknowledge the source.

- Plagiarism is forbidden. Copying answers directly or indirectly from solution manuals, web pages, or your peers is a violation of honor code. The assignments and code that you turn in should be written entirely on your own.

- Copying/soliciting a solution to a problem from the internet or another classmate constitutes a violation of the course's collaboration policy and the honor code and may have serious consequences.

- You may not actively search for a solution to the problem from the internet. This includes posting to sources like StackOverflow, Reddit, Chegg, CourseHero, etc.

- StackExchange Clarification: Searching for basic techniques in Python/C++ is totally fine.

- If you have taken this course prior to this semester and have done some/all of homeworks previous code or previous homework solutions may not be reused. You must start each homework from scratch.

- When in doubt, ask. If something doesn't seem right - you are not sure if you can use a resource or if you are feeling pressure to share a specific solution - please reach out to your instructor.

- Note: Other information on the Honor Code can be found at www.colorado.edu/policies/honor.html and https://www.colorado.edu/sccr/honor-code.

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure 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 race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation, or political philosophy.

For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

Requirements for Infectious Diseases

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all public health orders to reduce the risk of spreading infectious diseases.

The CU Boulder campus is currently mask optional. However, if masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class. Students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct & Conflict Resolution. Students who require accommodation because a disability prevents them from fulfilling safety measures related to infectious disease will be asked to follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

For those who feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the further guidance of the Public Health Office. For those who have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

Disability Services determines accommodations based on documented disabilities in the academic environment. If you qualify for accommodations because of a disability, submit your accommodation letter from Disability Services to your faculty member in a timely manner so your needs can be addressed. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance.

If you have a temporary medical condition or required medical isolation for which you require accommodation, please let me know. Also see Temporary Medical Conditions on the Disability Services website.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: honor@colorado.edu, 303-492-5550. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.

Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive an outreach from OIEC about their options for addressing a concern and the support resources available. To learn more about reporting and support resources for a variety of issues, visit Don't Ignore It.

Religious Holidays

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.
See the campus policy regarding religious observances for full details.

Mental Health and Wellness

Free and unlimited telehealth is available through Academic Live Care. Please note that at this time this service is not available to students outside of the United States.

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Data retention summary
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