

# CSCI 7000: Algorithmic Human-Robot Interaction, Spring 2018

Monday / Wednesday | 5:00pm – 6:15pm | KOBL 235



## Professor:

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## Description

As capabilities of actuators, sensors, artificial intelligence, and machine learning techniques increase, so too does the scope of environments within which autonomous robots may be deployed and the complexity of problems they will be tasked to solve. Importantly, these increasingly capable systems will often need to be deployed into human-populated environments, necessitating algorithms that are explicitly mindful of end users, interaction partners, and disinterested bystanders alike.

This course will examine existing algorithms in robotics with a focus on human-robot interaction and collaboration, developing new human-aware adaptations to autonomous planning and decision-making systems, enabling them to efficiently operate in conjunction with human partners or supervisors. We will investigate questions such as: How can human demonstration or feedback be leveraged to accelerate skill acquisition? How can we efficiently model human behaviors, then use those models to improve teamwork? How can a robot be more transparent in its decision-making or actions to improve co-worker safety?

## Format

The course will combine lectures with student-led paper presentations, focusing both on fundamental knowledge acquisition and discussion. Short quizzes will be given before lecture

begins to ensure understanding of the material for the day – these are not meant to be onerous and will be graded as {plus, check, minus}, as they are only meant to ensure the papers for the day were read. The course will culminate in a research project focused on characterizing or developing autonomous systems that operate safely and productively in the presence of (or collaboratively with) humans.

**Possible final project publication venues:**

Conference Papers: RSS, IROS, ICRA, CORL, HRI, RO-MAN

Short Papers: HRI Late-Breaking Report

## **Learning Objectives**

- Articulate challenges in building autonomous systems that interact with humans
- Apply machine learning techniques to enable human-robot collaboration
- Develop an understanding of computational models of verbal and non-verbal communication
- Apply learning from demonstration techniques to enable robots to acquire new capabilities and more rapidly generalize existing ones
- Effectively communicate scientific content
- Critique scientific literature with respect to experimental design and analysis
- Implement control algorithms on real robot hardware to design real autonomous systems

## **Textbook**

This course will not have a textbook, as all readings will be posted online. Readings will be drawn heavily from conference proceedings at HRI, RSS, CORL, AAI, IJCAI, AAMAS, and other top robotics publication venues.

## **Prerequisites**

This is a graduate research course designed to jump-start research in human-robot interaction. The course project may involve significant programming and engineering effort, and as such a strong programming and computer science background is required. Students will be working with physical robotic systems, and are expected to be strongly motivated to develop real autonomous systems that interact in human environments.

## **Accommodation for Disabilities**

If you qualify for accommodations because of a disability, please submit to your professor 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 Temporary Injuries guidelines under the Quick Links at the Disability Services website and discuss your needs with your professor.

## **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. In this class, please notify the instructor at least two weeks prior to any conflict due to a religious obligation to ensure proper accommodations can be made. The instructor may not be able to support conflicts when given less than two weeks advance notice.

## **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.

## **Discrimination and Harassment**

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 discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to 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 discriminated against should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or the Office of Student Conduct and Conflict Resolution (OSC) at 303-492-5550. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be found at the OIEC website. The full policy on discrimination and harassment contains additional information.

## **Honor Code**

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council ([honor@colorado.edu](mailto:honor@colorado.edu); 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and nonacademic sanctions (including but not limited to university probation, suspension, or expulsion). Additional information regarding the Honor Code policy can be found online and at the Honor Code Office.

## **Copyrighted Material**

Unless students are intentionally exploring the idea of remix and/or appropriation and have previously discussed this with the professor, they should avoid using copyrighted material in creative work for this course. Students are encouraged to create their own media assets (imagery, sound, etc.).

## **“Double Dipping”**

“Double Dipping,” or submitting work (paper, project, etc.) for this course that has already been submitted to other classes, is prohibited and is a violation of the CU Honor Code <http://honorcode.colorado.edu>.