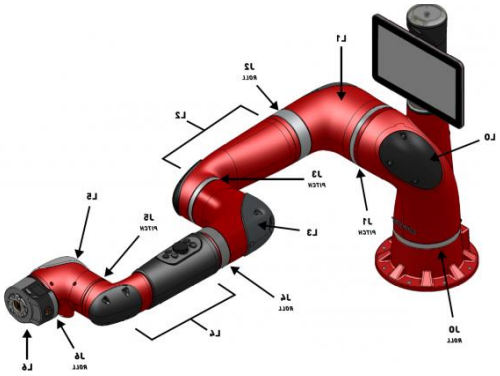
CSCI 3302: Introduction to Robotics, Fall 2020

Tuesday 3:55pm – 5:10pm | Wednesday 3:00pm – 4:40pm



Professor:

Brad Hayes (Bradley.hayes@colorado.edu)

Teaching Assistant:

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Office Hours are as posted on Canvas or by e-mail appointment.

Course Links:

Tuesday Lecture: https://cuboulder.zoom.us/j/97242829017

Wednesday Lab: https://cuboulder.zoom.us/j/98753602763

Description

The overarching learning goal of this class is to create an appreciation for the tight interplay between mechanism, sensor, and control in the design of intelligent systems. This includes (1) formally describing the forward and inverse kinematics of a mechanism, (2) understanding the sources of uncertainty in sensing and actuation as well as how to describe them mathematically, and (3) how to discretize the robot's state and reason about it algorithmically.

Learning Objectives

- Articulate challenges in building autonomous systems
- Experience a hands-on introduction to the theory and practice of fundamental ideas in robotics
- Generalist's exposure to interdisciplinary nature of robots, including an introduction to sensing, estimation, planning, control, architectures, implementation, and validation
- Improve technical communication and team-based development skills
- Formulate descriptions of technical problems
- Take ownership of an interesting robotics problem and provide a solution via a team-designed and team-developed project.

Textbook

"Introduction to Autonomous Robotics" by Nikolaus Correll
https://github.com/correll/Introduction-to-Autonomous-Robots

Grading

Homework (30%), Lab (40%), Final Project (25%), Attendance/Participation (5%)

Topics Covered (in loose chronological order)

- Robot Operating System
- Odometry
- Forward and Inverse Kinematics
- World Representations and Mapping
- Path Planning
- Sensors and Sensor Selection
- Feature Engineering and Navigation
- Applied Machine Learning for Robotics
- AI for Game Solving
- Introduction to Interactive Machine Learning and Human-in-the-loop Systems
- Mathematical Models for Handling Uncertainty
- Activity Recognition and Segmentation
- Robot Architectures, Social Robotics, State-of-the-art Review
- Socially Assistive Robotics and Debates

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website (www.colorado.edu/disabilityservices/students). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on 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 race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. 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 of Conduct.

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 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. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, 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 the Honor Code Office website.

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.

Requirements for COVID-19

As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building

requirements, and public health orders in place to reduce the risk of spreading infectious disease. Required safety measures at CU Boulder relevant to the classroom setting include:

- maintain 6-foot distancing when possible,
- wear a cloth face covering (over nose and mouth), especially when unable to maintain a distance of at least 12 feet,
- clean local work area,
- practice hand hygiene,
- follow public health orders, and
- if sick and
    - you live off campus, do not come onto campus (unless instructed by a CU Healthcare professional), or
    - you live on-campus, please alert CU Boulder Medical Services.

Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policies on COVID-19 Health and Safety and classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please see the "Accommodation for Disabilities" statement on this syllabus.

Before returning to campus, all students must complete the COVID-19 Student Health and Expectations Course. Before coming on to campus each day, all students are required to complete a Daily Health Form. {Faculty, add if applicable: In this class, you may be reminded of the responsibility to complete the Daily Health Form and given time during class to complete it.} Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home and complete the Health Questionnaire and Illness Reporting Form remotely.

In this class, **if you are sick or quarantined**, please let the professor know if you anticipate that your attendance and/or ability to complete coursework may be impacted **as soon as possible** so that we can develop an accommodation plan. Your first priority should always be your health and well-being.