

CSCE 439/839: Robotics: Algorithms and Applications

Spring 2020 COVID-19 Edition

Instructor

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Teaching Assistant

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Course Info

Lecture: MWF 3:30pm — 4:20pm in Avery 119
Lab: M 4:30pm — 5:20pm in Avery 119
Online on Canvas

COVID-19 and Moving to Online Format

Given COVID-19 and the move to an online course format, things will be different for all of us. Please bear with me as we adjust. I will do my best to communicate any changes and my expectations. Please do the same in return and ask if you have questions or concerns. I will primarily use **Canvas for communication**, but make sure to check your university email regularly as well.

The **class will be run asynchronously** with videos and reading materials posted in canvas. We will hold whole-class office hours during some of the regularly scheduled class times. This will allow us to review some of the topics in more depth based on student questions. **Dates for whole-class office hours will be posted on Canvas.** In addition, you can schedule time to meet with me individually at carrick.youcanbook.me.

The major **change to the course content and assessment** is that there will be no more lab group assignments and no final project. Instead, there will be an additional homework (the plan is for two more this semester) and there will be some short online activities and quizzes to help assess participation.

If you have difficulty accessing the online materials due to internet problems, sickness, family care, or anything else, please let me know and we will figure out a solution. Finally, if I do not respond to your messages within 24 hours, please reach out to Ajay in Canvas (or feel free to copy him on any messages).

Course Description

Robots play an increasingly important role in our lives, from assembling our cars and cell phones to vacuuming our rugs and flying recon missions. To create systems that work in the real world, the field of robotics requires robust theory and algorithms that are tightly integrated with hardware that is designed with engineering expertise.

~~This will be a hands-on, lab-based course where you will implement the algorithms you learn about in class on a small balancing robot that you will build in lab.~~ You will learn the fundamentals of robotics, as well as the cutting-edge in robotics research. Topics covered will include: control, navigation and path

planing, obstacle avoidance, manipulation and grasping, and robotic vision processing. By the end of the course you will know why robots are not yet folding our clothes and driving our cars, but you will also learn what is needed to make these possible in the future.

You will interface with the embedded system that controls the robot by using learning to program in ROS (Robot Operating System: www.ros.org). Programming will be in either C++ or Python, with an emphasis on C++. By the end of the course you will have a deep understanding of the design, programming, and interfacing of robot systems. This will prepare you for cutting edge careers in industry and research.

Course Website and email

The website for the course is: <http://cse.unl.edu/~carrick/courses/2020/439/>

This syllabus is subject to change, you will find the most up-to-date version of the syllabus on the course website, as well as information on readings, assignments, and projects. Please make sure to check it regularly. In addition to posting information and assignments on the course website, I will send messages via canvas or email. You are expected to check both daily.

Prerequisites and Requirements

Prerequisites: CSCE236 or ELEC222 and CSCE 310/311 or equivalent programming experience, MATH 314, senior/graduate standing, or instructor permission

Mastery of: C++ or other high-level languages, embedded systems, algorithm analysis.

Familiarity with: basic and advanced data structures, GNU/Linux operating systems, software development, linear algebra.

Exposure to: introductory Newtonian physics, probability and statistics.

Textbooks

Suggested: G. Dudek and M. Jenkin, Computational Principles of Mobile Robotics, Cambridge University Press, 2nd Edition, 2010.

Topics Covered and Outcomes

Topics covered will include: open and closed loop control, reactive control, localization, navigation, path planning, obstacle avoidance, dynamics, kinematics, manipulation and grasping, sensing, robot vision processing, and data fusion. See the course website for a detailed course schedule.

Mastery of: algorithmic design, implementation, and adaptation to real robots operating in uncertain environments, application development on robots.

Familiarity with: robot design and analysis, robot control, localization and navigation, robot vision techniques.

Assignments and Grading

All assignments are due via <http://cse.unl.edu/handin/>. Unless otherwise noted, all assignments are due before the beginning of class on the day they are due. Assignment due dates are announced in class.

Your final grade will be composed of a number of components. These are:

Percentage	Assignment
25%	Class, Lab, and Online Participation
45%	Homework
30%	Labs (2 labs already completed)

Class, Lab, and Online Participation

In addition to the class and lab participation from earlier in the course, this part of the grade will come

from participation in online quizzes and other activities.

Homework

There will be at least three homeworks over the course of the semester. These are **individual** assignments. It is ok to discuss concepts behind the problems in the homeworks with classmates, however, you cannot do them together. If you do discuss problems with classmates or other people, you must acknowledge this on the assignment (this will not lead to any grade reduction). As a metric for what level of discussion is allowed, it is ok to meet and talk over coffee about the assignment. It is not ok to show someone your solution or to work on the details of the problems together. In general any discussions should be limited to discussion and you should not be taking significant notes on the problems. **The best option is to discuss questions on a canvas discussion or to talk with the instructor or TA.** If in doubt, ask me questions about assignments.

Homeworks are due via handin by 3:30 Central time on the day that they are due. Late homeworks will receive a 15 point deduction per 24 hours late. That means that if you turn it in after class, instead of before, you will start with a 85% as the highest possible grade.

Labs

There will be no more labs in groups :(The two already completed in the course will be the only ones.

Final Project/Challenge

There will no longer be a final project. Aspects of this will be in the final homework.

439 Versus 839

This course is highly integrated and there are only small differences between the 439 and 839 versions of the course. For 839, the homeworks and labs will have additional questions and parts that are optional for students in 439.

University Writing Center

The Writing Center, located in 102 Andrews Hall and satellite locations from 5-7 pm in Adele Hall , is a free service for all UNL students, faculty, and staff. You can work with an individual writing consultant on any type of writing at any stage in your writing process. For an appointment, call 472-8803 or schedule online at <https://www.unl.edu/writing/home>.

CSE and UNL Policies

Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. The University's Student Code of Conduct [Links to an external site.](#) addresses academic dishonesty. Students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision.

All students enrolled in any computer science course is bound by the Computer Science and Engineering academic integrity policy:

<http://cse.unl.edu/academic-integrity-policy>

You are expected to read, understand, and follow this policy.

For this course, do not plagiarize (writing or code) and make sure to properly cite any sources you use. Any cheating or plagiarism will be reported to the Chair of your department and your Dean, and may result in zero credit for that assignment and an F for the course.

The CSE Department has an anonymous suggestion box:

<http://cse.unl.edu/department/suggestion.php>

that you may use to voice your concerns about any problems in the course or department if you do not wish to be identified.

Counseling and Psychological Services UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS); is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. Big Red Resilience & Well-Being (BRRWB) provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

Disabilities

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner. SSD contact information: 232 Canfield Admin. Bldg.; 402-472-3787.