CSCE 990: Robotics Today

Instructor

Dr. Carrick Detweiler (primary point of contact), carrick _at_ cse.unl.edu
Associate Professor
220 Schorr Center
Department of Computer Science and Engineering
University of Nebraska-Lincoln
Lincoln, NE 68508

402-472-2449

Co-Instructors

Dr. Justin Bradley, justin.bradley _at_ unl.edu
Dr. Brittany Duncan, bduncan _at_ unl.edu

Course Info

Fall 2019
Mon, Weds, Fri 10:30-11:20am in Avery 110
(Note: We will use a twice a week schedule with longer classes, tentatively Mon, Weds)
Instructor office hours
with Dr. Detweiler Mondays 9:30-10:30 in 220 Schorr and by email appointment.

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 course explores fundamental algorithms of robotics and how they are implemented and coupled with real world systems. The topics covered in this course will be based on input from the class and will generally cover topics in field robotics, cyber physical systems, unmanned aerial systems, and human robot interaction. We will explore these topics through the critical analysis of classic and contemporary articles in the field of robotics. By examining algorithms and systems used in the real world, we will determine what it takes to go from theory to implementation. In this class, students will present, discuss, and write analyses of robotics research. In addition, a semester-long group project will allow students to further explore areas of interest in robotics. The goal of this course is for students to gain an understanding of the challenges and current state of the art in robotics and to improve critical analysis skills.

Course Website and email

The website for the course is:

`http://cse.unl.edu/~carrick/courses/2019/990/`

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 information over email to the address you gave me at the start of the course. I expect that you will check your email on a daily basis. Please make proper arrangements if you will not be able to check your email or if your email address changes.

Prerequisites and Requirements

Mathematical maturity, comfort reading and writing journal articles
No textbook, readings will be available as links to online journals.

Topics Covered

We will cover a variety of topics in this course including localization, control, motion planning, vision, manipulation, multi-robot systems, flying robots, sensors, and mechanical design. Depending on student interest we will adjust the syllabus to cover areas in more or less detail. If you are particularly interested in covering a topic, please let me know.

Assignments and Grading

All assignments are due via email to carrick _at_ cse.unl.edu. Please include CSCE 990 at the beginning of the subject line. I will respond to you to acknowledge that I received the assignment. If you do not receive a response from me within 24 hours, assume I did not receive your assignment and try to contact me again. Assignments and due dates will be announced in class. Unless otherwise noted, all assignments are due at the beginning of class on the day they are due.

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

Percentage	Assignment
20%	Class Participation
20%	Article Reviews
20%	Article Presentation and Write-up
30%	Final Project
10%	Final Project Review

Class Participation

Participation is critical in this class and counts for 20% of your grade. You are expected to complete all readings and come prepared with questions and comments on the articles. Simply coming to class is not sufficient for obtaining full marks for participation; you should actively participate in discussions.

We will start each class by going around and having people give a comment about the article. The comments may be about an assumption the article makes or a strength, weakness, or question about the article.

It is acceptable to use computers to read papers and take notes. However, I expect that their use will not be a distraction. Texting, tweeting, facebooking, etc. can wait until after class. Do not use your cell phone during class. It is obvious and is a distraction not only for you, but for me and your classmates as well.

Article Review

You will do five article reviews over the course of the semester: two of your choice; one for the article you present; and two reviews of classmates' final projects.

The first two, self-selected reviews, can be done at any time up until **Weds, Nov 20, 2019**. For each of these reviews, you will review one of the articles we are reading in class. You are encouraged to do these early in the semester. Do not leave them until the last days of class. The review is due at the beginning of the class during which the article is presented. The third, is due 24 hours before the class during which you present an article (see below). The final review, of two of your peers' final papers is due **Weds, Dec 2, 2019** at the beginning of class.

Writing detailed and constructive reviews of academic articles is a crucial part of being a researcher in both academia and industry. You should write your review as if you were evaluating the article for publication (e.g. the review is for a journal editor and the author, although I expect your reviews to be more

detailed than a standard review). There is no standard format for the review, although it should be detailed and typically around 4 pages double spaced (this is somewhat longer than you would submit for most article reviews). It should include, but by no means be limited to:

- A *brief* summary of the paper and technical approach;

- A brief summary of your review (e.g. identify the key strength and weakness of the article. This is not a summary of how you did in reading it, it is a summary for an "editor" reading your review.);

- Discussion of the assumptions made in the paper;

- Questions the paper raises for you and the community;

- Strengths and weaknesses of the paper (you should make sure to quantify these, for instance, "a minor weakness of this paper is" or "a significant strength");

- Constructive feedback (e.g. areas to be expanded or improved);

- Analysis of the related work and its completeness (or lack of);

- Comments on the quality of the organization, writing style, and grammar;

- Would you recommend this article for publication.

Although the articles we are reading have been already been published, for the purpose of the review pretend that it has not (there is always room for improvement) and that you have been asked to review the paper. Remember to give positive feedback that will allow the authors to improve the article, but do not be afraid to critical.

Article Presentation and Write-up

In this course you (and possibly a partner) will lead one class in the discussion and analysis of an article. I will assign presentation dates in the first week of the course.

In addition to the presentation, you will need to write an article review (see above for format) for the article you are presenting. If you are presenting with a partner, each partner is responsible for writing their own article review. This is due 24 hours before the start of the class you are leading. I also encourage you to meet with me to discuss the article ahead of time. Please don't wait till the last minute to read the article.

You can prepare slides for the presentation or use the board. At the start of the class each person in the class will be asked to give some comments about the article (e.g. comment on the strength, weakness, assumptions, etc. of the article). This can be used as the basis for discussion, although giving overview of the article at this point is also useful. In addition, it is often useful to follow up on references in the paper and present more background than is present in the paper. Similarly, it is often interesting to look to see if there are any more recent papers that build on the original paper.

I will make a suggestion as to a paper you can present, however, if there is an alternative, related, paper you would like the class to read instead, that is possible as well. Just please make sure to talk with me at least 4 days in advance to give the class sufficient time to read the article.

You will be graded on both your presentation and article review writeup. In addition, the students in the class will fill out evaluations on your article presentation that I will summarize and use to aid me in grading.

Final Project

The final project for this course is to write an article related to the field of robotics. The final writeup is due **Mon, Nov 25, 2019** at the start of class. This is an opportunity to combine your own research with what you have learned in this course. This can an individual or small group project. Project proposals will be due early in the semester and you will be working on your project throughout the semester. There

will also be periodic project status reports. In addition, you will put together a short video describing your project. More details on the proposal and project will be discussed in class.

We will use the last week of class to do final project presentations. You will be graded on your article, presentation, and video. In addition, you will receive an article reviews from your classmates before your presentation.

Final Project Review

Each student will review two of their classmates' final project articles. I will assign the project you will review. This will be a blind review (the author will not know who reviewed it). This should follow the guidelines of the article review described above. This is due **Weds, Dec 2, 2019** at the start of class.

Absences

Students are expected to attend all classes. Any absences will lead to a reduction in your class participation grade. If you need to be absent (e.g. to attend a conference), please discuss this with me as early as possible in the semester. Not showing up for class is not an excuse for not turning in an assignment or giving a presentation.

University Writing Center

The University of Nebraska-Lincoln Writing Center can provide you with meaningful support as you write for this class as well as for every course in which you enroll. Trained peer consultants are available to talk with you as you plan, draft, and revise your writing. Please check the Writing Center website (http://www.unl.edu/writing/) for locations, hours, and information about scheduling appointments.

CSE and UNL Policies

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.

Disabilities

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. This includes students with mental health disabilities like depression and anxiety. It is the policy of the University of Nebraska-Lincoln to provide individualized accommodations to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 232 Canfield Administration, 472-3787.