

CSCE 990: Robotics: Algorithms and Applications

Instructor

Dr. Carrick Detweiler
Assistant Professor
109 Schorr Center
Department of Computer Science and Engineering
University of Nebraska-Lincoln
Lincoln, NE 68508

402-472-2449
carrick _at_ cse.unl.edu

Course Info

Fall 2010
MWF 10:30-11:20 in Avery 118
3 Credits and applies towards systems track

Office hours: MW 11:30-12:30 and by 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. Topics covered in this class include motion planning, state estimation, localization, vision-based navigation, manipulation, multi-robot systems, underwater robots, flying robots, and humanoid robots. We will explore these topics through the critical analysis of classic and contemporary articles in the field of robotics. By examining algorithms used in real world systems, 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/2010/990/>

You will find the most up-to-date version of the syllabus at that location, 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

Topics Covered

We will cover a variety of topics in this course including localization, control, motion planning, vision, manipulation, state estimation, multi-robot systems, underwater robots, flying robots, and humanoid robots. 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. Unless otherwise noted, all assignments are due at the beginning of class on the day they are due. Assignment due dates are announced in class and posted on the google calendar located on the course website.

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

Percentage	Assignment
20%	Class Participation
10%	Article Review
20%	Article Presentation and Write-up
40%	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 each person 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 three article reviews over the course of the semester: one of your choice; one for the article you present; and one I will assign for the review of a classmate's final project.

The first, self-selected review, can be done at any time up until November 22nd. In this review, you will review one of the articles we are reading in class. This review is due at the beginning of the class during which the article is presented. The second, is due 24 hours before the class during which you present an article (see below). The third review, of one of your peer's final papers is due Friday, December 3rd 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. 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 an actual article review). It should include, but by no means be limited to:

- A *brief* summary of the paper and technical approach;
- Discussion of the assumptions made in the paper;
- Questions the paper raises for you and the community;
- Strengths of the paper;
- 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 3 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 Monday, November 22nd at the beginning 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 Monday, October 4th at the beginning of class. More details on the proposal and project will be discussed in class.

We will use the last two weeks of class to do final project presentations. You will be graded on your article and presentation. In addition, you will receive an article review from one of your classmates.

Final Project Review

Each student will review one of their classmate's 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 Friday, December 3rd at the beginning of class.

Absences

Students are allowed two absences during the semester. Any absences beyond this will lead to a reduction in your class participation grade. There is no exception to this, so it is best to save these days for times when you are sick and cannot come to class. You do not need to notify me if you will be absent, although it is appreciated. Not showing up for class is not an excuse for not turning in a paper or other assignment.

The **exception** to the "free" absences is when you are scheduled to present. If you do not give your presentation on your scheduled day you will receive a zero for the presentation. An absence for your presentation may be excused in the case of an illness or family emergency if acceptable written evidence is given and you notify me as soon as possible. Even if you are sick or leaving town on short notice you should be able to have a friend notify me that you will be missing your presentation. Please do so as soon as possible so that I can plan accordingly so you do not waste the time of the other students in the class.

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

You must abide by the Computer Science and Engineering academic integrity policy, which can be found here:

http://cse.unl.edu/ugrad/resources/academic_integrity.php

In particular, for this course, do not plagiarize 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 will result in an F for the course. This includes working with others without acknowledging the collaboration. Presenting papers and doing projects related to your own research or other courses is encouraged, however, you must obtain approval beforehand.

Disabilities

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation 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, 132 Canfield Administration, 472-3787 voice or TTY.