

CSCE 990: Robotics Today

Instructor

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Course Info

TTh 2:00pm - 3:15pm in Avery 118

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 cover a wide range of topics in robotics with a focus on field robotics and unmanned aerial systems. 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 Canvas/email Communication

The primary website used for the course is the Canvas page. In addition, similar materials can be found on the public webpage for the course: <http://cse.unl.edu/~carrick/courses/2022/990/>, however, the Canvas page should be used as the primary reference.

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. I will send messages via canvas or email. You are expected to check both daily.

Prerequisites and Requirements

Graduate standing or permission from instructor. Helpful skillsets include mathematical maturity, and comfort reading and writing published articles.

No textbook, readings will be available as links to online journals.

Course Required Materials

Readings and resources are available online.

Laptop highly recommend.

Topics Covered and Outcomes

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 Canvas. Assignment due dates are announced in class and posted on Canvas. Your final grade will be composed of a number of components. These are:

Percentage	Assignment
10%	Class Participation
10%	Discussion Board Participation
15%	Article Reviews (2x)
20%	Article Presentation, Written Review, and Discussion
30%	Final Project
15%	Final Project Reviews (2x)

Class Participation

You are expected to complete all readings and come prepared with questions and comments on the articles. Attendance is mandatory unless excused in advance. Simply coming to class is not sufficient for obtaining full marks for participation; you should actively participate in discussions.

Discussion Board Participation

The goal of the discussion board is to start off the discussion about the upcoming article we will be discussing. This will allow us to learn more about the article and will help the presenter focus the presentation on topics of interest that come from this discussion.

Each student will be required to either ask a question about or post a comment on the paper under discussion. Each student will also be required to respond to any questions posed to them on the discussion board. In other words, posting once and forgetting about it is not sufficient; you must be actively engaged in the discussion. Discussion posts will be started at least 96 hours before the article is discussed in class and posts must be completed at least 24 hours before class to count.

Article Reviews (2x)

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 **Nov 17**. 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 reviews are due 96 hours before the article is discussed in class. So for classes on Tuesday, this means by Friday at 2pm and for classes on Thursday, this means by Sunday at 2pm. The final review, of two of your peers' final papers is due **Dec 1** 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 2 pages single 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.

You will be graded by how well you address each of the bulleted items. Points may be deducted for missing elements, lack of detail, or poor grammar.

Article Review, Discussion Board Lead, and Presentation

Everyone will lead the presentation, review, and discussion of one paper this semester. Dates for these assignments will be posted in the second week of the course. I highly recommend you meet with the instructor in advance of creating your review and presentation if you have questions.

The lead should write a written review (see above) and create a post to discuss it 96 hours before the class where it will be presented. So for classes on Tuesday, this means by Friday at 2pm and for classes on Thursday, this means by Sunday at 2pm. Then all other students should post questions and engage in the discussion. The lead should engage and respond to posts and use the discussion to help shape the presentation. Discussion ends 24 hours before the class where the article will be discussed. Then the lead will create a presentation on the paper and lead the in-class discussion of the paper.

More specifically, you will need to do a:

- Written Review (6 pts): **Submitted 96 hours before class**. Submit your review to the appropriate Canvas assignment. The submission must be in pdf format.

- Discussion Board Lead (6 pts): **Posted 96 hours before class.** Create a new discussion topic on Canvas with a title that includes the date that it will be discussed in class and the paper title (e.g. “Sept 14: Why Robotics is the Best”). Copy your review inline in the discussion topic so that it is easy for everyone to reference (do not just attach a pdf, although you can include it in addition if you would like). Double check that the formatting looks appropriate. Then respond to and lead the discussion of the article.
- Article Presentation and Discussion (8 pts): **Presented during class.** Prepare slides that summarize both the article, your review, and any additional interesting points that came up during the online discussion. It may also be useful to try and cover background or other topics that came up in the discussion or to cover more recent papers that cite this paper. At the end of the presentation, you will lead further discussion and analysis of the paper. It is completely appropriate to go around the room and ask people to comment on the article (e.g. comment on the strength, weakness, assumptions, and questions about the article) as part of the discussion.

Final Project

The final project for this course is to write an article related to the field of robotics. The final writeup is due **Nov 22** at the start of class. This is an opportunity to combine your own research with what you have learned in this course. This can be 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 article reviews from your classmates before your presentation. You will use these reviews to revise and submit a final version of your paper on **Dec 9**.

Final Project Review (2x)

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 **Dec 1** at the start of class.

Grading Scheme

The grading scale for this course is: A 93.00-100%; A- 90.00-92.99%; B+ 87.00-89.99%; B 83.00-86.99%; B- 80.00-82.99%; C+ 77.00-79.99%; C 73.00-76.99%; C- 70.00-72.99%; D+ 67.00-69.99%; D 63.00-66.99%; D- 60.00-62.99%; F 0.00-59.99%. The instructor reserves the right to decrease the thresholds for some letter grades (e.g. make an A- start at 89.1%). A+ is only given in exceptional circumstances.

Late Work Policy

No late work will be accepted. That is, you will get a zero if it is late. I will make exceptions to this policy under certain situations at my discretion. If you have extenuating circumstances please send me an email BEFORE the deadline.

School of Computing 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 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 School of Computing course is bound by the academic integrity policy:

<http://computing.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 head of your department and your Dean, and may result in zero credit for that assignment and an F for the course.

Assistance for this course and other School of Computing courses may also be available at the Student Resource Center:

<https://computing.unl.edu/current-undergraduate#SRC>

The School of Computing has an anonymous suggestion box:

<https://computing.unl.edu/anonymous-department-feedback-form>

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

Instructional Continuity Plans (a.k.a. snow days)

If in-person classes are canceled, you will be notified of the instructional continuity plan for this class by Canvas.

UNL Course Policies and Resources

Students are responsible for knowing the university policies and resources found on <https://go.unl.edu/coursepolicies>, including:

- University-wide Attendance Policy
- Academic Honesty Policy
- Services for Students with Disabilities
- Mental Health and Well-Being Resources
- Final Exam Schedule
- Fifteenth Week Policy
- Emergency Procedures
- Diversity & Inclusiveness
- Title IX Policy
- Other Relevant University-Wide Policies