CS 491X/691X/791X: Robotics for Humanity

Course Info:

Date/Time: MW 2:30-3:45pm
Location: SEM 344
Instructor: Dr. David Feil-Seifer (dave@cse.unr.edu)
Office Hours: MW 1-2pm, T 4-5pm

Objectives: The purpose of this class is for students to:

Gain a knowledge of basic robotics fundamentals such as: sensing, navigation, planning, and tele-operation; understand how basic robotics concepts are applied to understanding Human-Robot Interaction (HRI); learn and apply research methods commonly used in the HRI field; read and evaluate scientific literature to determine follow-up areas for research exploration and constructively criticize experiment design; understand basic robotics programming concepts using a robotics control framework widely used in the field; and complete a group research project extending a current robotics capability or studying a new facet of Human-Robot Interaction.

Students who take this course should develop the following abilities:

1. An ability to apply knowledge of computing, mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints specific to the field
4. An understanding of professional, ethical, legal, security and social issues and responsibilities
5. The broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society.
6. A knowledge of contemporary issues
7. An ability to use current techniques, skills, and tools necessary for computing and engineering practice
8. An ability to apply design and development principles in the construction of software systems or computer systems of varying complexity
Course Guidelines:

Grading:
The final grade will be made up of:
- 20%: Paper presentations, classroom discussion, and quizzes
- 20%: Paper critiques
- 60%: Research projects

Prerequisites:
CS302 Data Structures

Etiquette:
The best etiquette, especially for projects, is to plan ahead. Make sure that you have all the resources you need before you start working. Get your code done as quickly as possible and set realistic goals for your project. When you encounter difficulties ask your other group members or other groups before asking the instructor. Remember, there are far fewer instructors than there are groups. However, do not hesitate to ask when you get stuck.

Etiquette for in-class discussions are clear. Try not to interrupt. Do not state the same point over and over again. Speaking more does not necessarily mean a good discussion grade. Speaking well does. Do not interfere with other people adding to the discussion or monopolize the discussion.

Assignments:

Paper Critiques: At the beginning of each lecture, students will submit a critique of each of the papers discussed during that lecture. This critique must be constructive in nature. If an aspect of an experiment design or analysis is questioned, the critique must include a potential remedy. If there is no questionable aspect of a particular paper, then the critique must provide a unique follow-up question inspired by the results of the paper. Critiques should be 1-2 pages in length for each paper.

Paper Presentations: Each paper will be presented by the students in class. Students will be assigned papers based on preference and availability.

Discussion: Each week will feature a classroom discussion regarding the papers. Students are encouraged to discuss issues arising in their critiques of the relevant papers. Participation in this discussion will be graded. Quantity is far less important than quality. As with the
critiques, constructive comments will be prized over simply saying “This method is not good.”

**Research Project:** Students will submit group research projects. Groups up to 4 people will be allowed. The final milestone of this project is a short (6-8 page) paper summarizing the motivation, approach, and results of the project. Project timeline is as follows:

- **Week 5 Group ideas due:** For this milestone, students should turn in the members of their group and 1-paragraph descriptions of three distinct projects to be discussed with the TA/Instructor.
- **Week 6 Project proposal draft due:** Groups must turn in a short project description of the motivating problem and how the project will address this problem. Think of this milestone as the “Introduction” and “Background and Motivation” sections of a research paper.
- **Week 8 Detailed project proposal due:** Groups will turn in an extended project description detailing the approach, experiment design, and analysis plan for any data collected. Think of this milestone as the Introduction, Background, Approach, Experiment Design, and the outline of the Analysis sections. Clearly state the hypotheses of the experiment. Groups will present a 15-20 minute presentation about their project idea in order to groups to receive constructive criticism from the rest of the class.
- **Final papers will be due on May 5th.** Groups will turn in a completed research paper at the beginning of class. I can review, edit and return papers turned in more than a week early, if you are concerned about your work.

**Academic Honesty Policy**

Class Conduct: A student may be dropped from class at any time for negligence or misconduct, upon recommendation of the instructor and with approval of the college dean. Students may also be dropped for non-attendance upon indication of the instructor.

**Definitions**

Academic dishonesty is against university as well as the system community standards. Academic dishonesty includes, but is not limited to, the following:

- **Plagiarism:** defined as submitting the language, ideas, thoughts or work of another as one's own; or assisting in the act of plagiarism by allowing one's work to be used in this fashion.

- **Cheating:** defined as (1) obtaining or providing unauthorized information during an examination through verbal, visual or unauthorized use of books, notes, text and other materials; (2) obtaining or providing information concerning all or part of an examination prior
to that examination; (3) taking an examination for another student, or arranging for another person to take an exam in one's place; (4) altering or changing test answers after submittal for grading, grades after grades have been awarded, or other academic records once these are official.

**Sanctions for Violation of Academic Standards**

Sanctions for violations of university academic standards may include the following:

(1) filing a final grade of "F"; (2) reducing the student's final course grade one or two full grade points; (3) awarding a failing mark on the test or paper in question; and (4) requiring the student to retake the test or resubmit the paper.

A student found responsible for violating this policy may not withdraw from the course in question. A student failed in a course due to academic dishonesty may not utilize the "repeat option" for that course.

A student may also be subject to discipline for academic dishonesty pursuant to the provisions of the Board of Regents Code, Title 2, Chapter 6.

**Schedule:**

**Unit I - The Science of HRI, Fundamentals:**

**Week 1**
1/21 - Intro

**Week 2**
1/26 - From human-human to human-machine interaction
1/28 - Implementing a robot system

**Week 3**
2/2 - Experimental Robotics
2/4 - More Experimental Robotics

**Week 4**
2/9 - Evaluating HRI
2/10 - Evaluating HRI II
Week 5
2/16 - Presidents’ Day (no class)
2/18 - Modeling

Unit II - hRi:

Week 6
2/23 - Assistive Technology
2/25 - Navigation (Out of town)

Week 7
3/2 - Implementing a robot system (Out of town)
3/4 - Teleoperation (Out of town)

Week 8
3/9 - Project Presentations I
3/11 - Project Presentations II

Week 9
3/16 - Spring Break
3/18 - Spring Break

Week 10
3/23 - Best of HRI I
3/25 - Best of HRI II

Unit III: HRI in the World

Week 11
3/30 - Values / Ethics
4/1 - Ethics II

Week 12
4/6 - Ethics III
4/8 - Socially Assistive Robotics
**Week 13**

4/13 - Socially Assistive Robotics, ASD
4/15 - SAR, Planning

**Week 14**

4/20 - SAR, Medicine
4/22 - TBD

**Week 15**

4/27 - Rescue Robotics
4/29 - Modeling Interaction

**Week 16**

5/4 - Final papers due: Video Day