

16-867 Human-Robot Interaction

Spring 2017

Course information:

Lectures: M/W 12:00-1:20pm, NSH 3302

Website: <http://personalrobotics.ri.cmu.edu/courses/16867/>

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Course Description: This graduate-level course focuses on the emerging field of human-robot interaction, bringing together research and application of methodology from robotics, human factors, human-computer interaction, interaction design, cognitive psychology, education and other fields to enable robots to have more natural and more rewarding interactions with humans throughout their spheres of functioning. This course is a combination of state-of-art reading and discussions, focused team exercises and problem-solving sessions in human-robot interaction, and a special team project resulting in the implementation of a human-robot interaction system. This new area of inquiry brings together diverse areas of expertise, and so this course includes some guest lectures by researchers in related fields.

Prerequisites: This is a graduate course intended for those considering serious research in human-robot interaction. The course project may involve significant programming, therefore a solid mastery of computer programming languages is a prerequisite for this course as well as a solid understanding of research methodologies.

Text: There is no required text for this course, although a number of textbook sections and articles will be assigned as reading. The assigned reading will be made available on the course website in pdf format. As part of this course, we will be reading and discussing sections of the book

Course Objectives:

Upon successful completion of this course, you should be able to:

- Interpret and summarize seminal papers in HRI and their findings
- Identify relevant HRI principles and assess their potential impact in a new application (e.g. trust, engagement, social factors)
- Formulate new HRI hypotheses for research projects and place them in the larger context of the field
- Plan and design an HRI experiment using sound methodology and sufficient support from prior work
- Summarize, document, and present an HRI research project, taking into account the broad multidisciplinary audience of the HRI community
- Build a working prototype to test HRI hypotheses (ranging from fully programmed interaction system to wizard-behind-the-curtain mockups)
- Critically evaluate experimental design in HRI research by identifying weaknesses, assumptions, confounds and biases

Evaluation

- Reading Assignments: The readings for this course are diverse and intended to provide a broad familiarity with the field of HRI. In some cases, relevant reading is

assigned to enable students to get the most out of guest speakers' presentations and in others is to serve as a backdrop to in-class discussions. Doing the reading late, in either case, is not appropriate. For each reading a simple set of questions will also be distributed, and answers to these questions must be emailed to 16867-instructors@lists.andrew.cmu.edu at least 1 hour **before** class begins. These answers are generated on a pass/fail basis and demonstrate you took the time to read the assignment. ***Partial completion or late completion counts as a fail for that particular assignment.*** Please send answers in plain text, not as sophisticated attachments.

- In-class Participation: This course is interaction-intensive. We have expended considerable effort to line up an interesting set of guest speakers, and so an important class requirement is attendance of those guest speakers' presentations and active participation in discussions. This is the most qualitative of all evaluation components, but we care about your ability to engage and probe the speakers; this enriches the class considerably.
- Group Semester-long Projects: This represents the majority of your out-of-class work for the semester. You will perform this work in teams of 4, consistent throughout the semester. After forming teams early in the class, each team will select a scenario and application for which they will design a human-robot interactive concept to address issues of we will choose together. The design challenge is to be extremal; we will explain and discuss this requirement in class. Each team will document their design and prototyping process, as described below. This abbreviated "process documentation" will exist on a web site to be designed by each team. In addition to the creation of the process documentation web site, each team will make two in-class presentations, and all projects will be featured in a final, public PHRI presentation series to be held at the end of the semester.
 - The final presentations shall include a conceptual demonstration of the interaction system, which may or may not include audience participation. The range of possible working prototypes is very broad, from a wizard-behind-the-curtain mockup to a fully programmed interaction system. The intended form of the working prototype will be formulated and approved early in the semester.
 - The web-based process documentation shall include:
 - Problem statement and measures of success / evaluation criteria
 - Design and User research results
 - A study in form/morphology and material for the physical embodiment
 - A study of interaction sequences / storyboarding
 - Preliminary mockup evaluation results (base this on testing with classmates, friends)
 - Open design and open source for final working prototype system
 - Slides from both in-class presentations and final poster for the open house
 - Bibliography of sources investigated/used for this inquiry

Grading

Assignment	Type	Due	%
Reading Assignments	Individual	11am each class day	15
Class Participation (discussion, attendance, teamwork, etc.)	Individual	12-1:20pm each class day	15
Draft Project Statement	Group	Feb 1	5
Project Statement and Brief Presentation	Group	Feb 8	15
Research Presentation	Group	Feb 22, 27	10
Project Status Presentation	Group	Mar 27, 29	10
Project Final Presentation	Group	Apr 26, May 1, 3	25
Quality of Project Critiques	Individual		5

Tentative Schedule

Wk	Date	Topic	Assignments Due
1	Wed 18 Jan	Intro: Course requirements, semester-long project remarks	
2	Mon 23 Jan	Foundations: Communication	Burke, Barnlund
2	Wed 25 Jan	Survey of HRI	Goodrich, optional: Fong
3	Mon 20 Jan	Foundation: Design	Dourish
3	Wed 1 Feb	HRI Today: Robot expressing emotion	Leyzberg, Draft Project Statement due
4	Mon 6 Feb	HRI Today: Panorama and telepresence	Lazewatzky & Smart
4	Wed 8 Feb	Project Statement briefs presentations	Final Project Statement due
5	Mon 13 Feb	Robot Futures & community	DiSalvo (Local Issues)
5	Wed 15 Feb	Design and HRI	
6	Mon 20 Feb	HRI and Human Factors	
6	Wed 22 Feb	Research Presentations	
7	Mon 27 Feb	Research Presentations	
7	Wed 1 Mar	Human Factors & HRI	TBD
8	Mon 6 Mar	Shared Autonomy	TBD
8	Wed 8 Mar	HCI and Human Factors	Forlizzi and Sheridan (1,3,9)
	Mon 13 Mar	Spring Break	
	Wed 15 Mar		
9	Mon 20 Mar	Agency	Mid-term Course Reviews, Groom & Nass
9	Wed 22 Mar	QoLT: Robot Caregivers	Borestein, Beer
10	Mon 27 Mar	Project Status Presentations	
10	Wed 29 Mar	Project Status Presentations	
11	Mon 3 Apr	Telepresence	Atherton, Tsui
11	Wed 5 Apr	Human-Robot Relations	Mutlu & Mumm, Sparrow
12	Mon 10 Apr	Education – Guest lecture by Jennifer Cross	Cross et al., Arts & Bots paper
12	Wed 12 Apr	TBD	TBD
13	Mon 17 Apr	CEO of Me, Inc. HRI discussion Human-Machine conglomerates	
13	Wed 19 Apr	HRI and the Law	Calo
14	Mon 24 Apr	Project work time	
14	Wed 26 Apr	Project Final Presentations	
15	Mon 1 May	Project Final Presentations	
15	Wed 3 May	Project Final Presentations	

Reading List

A Grammar of Motives, Burke. Introduction (pp. xv – xxiii), Substance (pp. 29 – 35).

"Communication: the context of change," Barnlund. pp. 6 – 24.

Where the Action Is, Foundations of embodied interaction, Dourish. Chapter 1 (pp. 1-23, History of Interaction), Chapter 2(pp 40-53, Tangible computing), Chapter 4 (pp 99-126, Embodied Interaction).

"Human-Robot Interaction: A Survey," Goodrich & Schulz

"Robots that express emotion elicit better human teaching," Leyzbert..Scassellati

"A panorama interface for telepresence robots," Lazewatsky, Smart

"Local Issues, Local Uses: Tools for Robotics and Sensing in Community Contexts," DiSalvo et al.

"Design Patterns for HRI", Kahn

"Fostering Common Ground in Human-Robot Interaction," Kiesler.

"Interface Lessons for Fully and Semi-Autonomous Mobile Robots," Steinfeld.

Humans and Automation: system design and research issues, Sheridan. Chapter 1 (pp. 2-13, Introducing human factors), Chapter 3 (pp 54-68, Analysis and design process), Chapter 9 (pp 163-181, Social issues of humans and automation).

"Assistive Robotics", Forlizzi, DiSalvo, Gemp

"The Robotic Autonomy Mobile Robotics Course: Robot design, curriculum design and educational assessment," Nourbakhsh et al.

Arts & Bots: Application and Outcomes of a Secondary School Robotics Program, Jenn Cross, Emily Hamner, Chris Bartley, Illah Nourbakhsh

"The Personal Exploration Rover: Educational assessment of a robotic exhibit for informal learning venues," Nourbakhsh et al.

"Designing Robots for Long-term Social Interaction," Gockley, ...Simmons,....

"Robot Caregivers," Borenstein

"Can Robots be Teammates?" Groom & Nass

"Mobile Robot Presence System for Older Adults," Beer & Takayama

"Exploring Use Cases for Telepresence Robots," Tsui et al.

"Perception by proxy: humans helping robots to see in a manipulation task," Atherton & Goodrich

"March of the Robot Dogs," Sparrow

"Human-robot proxemics: physical and psychological distancing in human-robot interaction," Mumm & Mutlu

"Robot Ethics," Sawyer

"Robots and Privacy," Calo (book chapter)

"Authenticity in the age of digital companions" – essay, Sherry Turkle