Cognitive Science @ Yale

Directed Research + Directed Reading

Notes

'Directed Reading' and 'Directed Research' courses can be excellent ways to gain experience beyond traditional classwork. Such courses pose some danger, though, in that they do not typically have the same level of formality and oversight as other courses. Thus, the information requested below ***must*** *be provided before you will be allowed to register for these opportunities. Note that many — but not all — research activities will be appropriate candidates for academic credit. Those that aren't appropriate typically involve little intellectual engagement with the research — e.g. just running subjects for a professor on a 'pre-packaged' project. The most common assessment tool at the end of a semester will be a final write-up of the research, to be assessed by the research supervisor. If you have questions about these courses, please contact the DUS, Josh Knobe, by email (joshua.knobe@yale.edu). Please do so as far as possible before the registration deadline of the semester in which you plan to register for one of these courses.*

Instructions

1. Collect the information below, including the course advisor's signature on ***both*** *this page and your attached pages*
2. Bring this form and the requested attachments to the DUS, Josh Knobe, to review
3. After obtaining the DUS' signature, deliver the form and attachments to the Registrar's office, in ***Kirtland Hall 109***

Name : Sarim Abbas **Class of** : 2020

College : Pauli Murray **Advisor** :

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Course Advisor's Name : Professor Marynel Vázquez

Advisor's Department : Computer Science

Advisor's Email Address : marynel.vazquez@yale.edu

Advisor's Phone Number :

Course you plan to take : Directed Research CGSC 471

Directed Research [CGSC 471 (Fall), 472 (Spring)] or Directed Reading [CGSC 473 (Fall), 474 (Spring)]

Information to provide on attached pages(s), with course advisor's signature

1. A 1-paragraph description of the project (for CGSC 471/472) or topic (for CGSC 473/474)
2a. For CGSC 471/472, a 1-paragraph description of the role(s) you will play in this project
2b. For CGSC 473/474, **a syllabus of readings, with full references and dates**
3. A description of how you will be assessed, ***including some form of mid-term evaluation***
4. A statement of how frequently you'll be meeting with your advisor

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Course Advisor's Signature :

DUS Signature :

1a. Description

Human-robot interaction is a key area of robotics research today. Inviting volunteers to lab experiments, however, must be a well-choreographed exercise, which is time-consuming and expensive to setup. An alternative is to keep robots in public spaces, enabling rich and real-time collection of data. However, this presents its own unique challenges. hitchBOT is an example of an experiment with potential that ended poorly when human-robot interaction was not constrained. We will develop a set of robot behaviors and systems that will invite users to interact, provide instructions for the interaction, and attempt to keep the robot safe amidst uncertainty.

One such system is a projection-mapping system. Projection-mapping is a technique that turns irregularly shaped objects into video-display surfaces. As applied to robots, they provide a novel, extensible, and reprogrammable interface for communicating ideas and constraints with human users. For example, a robot may project a boundary around it, beyond which those who enter are perceived as threats – a form of "personal space". Alternatively, a robot may project visualizations of its "vitals" onto its relevant body parts.

2a. Role played

I will work to bring a robot up to parity with a completed prototype. I will install a new micro-controller in the robot to collect rich sensory data such as force applied.

I will develop a projection-mapping system to designate appropriate human interactions and warn against inappropriate ones in a public setting. Projection-mapping is a multi-step process that requires content generation, projector calibration and video masking. For this particular use case, the projection content must also be rendered in real-time and be a function of sensory data. I will collaborate with another member of the lab to set up the system. I will start by creating a model of the scene and setup the projectors, and trial static footage. Then, we will work together to create a system for real-time video generation and display.

3. Mid-term assessment

The project relies on obtaining rich data from the robot's sensors that might paint a picture of how passerby interact with it. For instance, voltage data from one of the actuators may serve as a proxy for physical force applied. The current micro-controller (Arbotix-M Robocontroller) cannot make use of this data. The midterm evaluation will use as a checkpoint the successful installation and analysis of a new controller (Dynamixel U2D2) to make use of new sensory inputs.

4. Frequency of meeting with advisor

Approximately 8-12 hours/week. Meetings every week.