Marie: An Artificially Intelligent Camera

Student: Kendrick Umstattd | Advisor: Professor Marynel Vazquez
kendrick.umstattd@yale.edu | marynel.vazquez@yale.edu
January 14, 2019
Senior Project Proposal, Spring 2019

To Whom It May Concern:
My name is Kendrick Umstattd, and I am a senior at Yale majoring in Electrical Engineering and Computer Science. For my senior project, I am working with Professor Marynel Vázquez (marynel.vazquez@yale.edu) to program an artificially intelligent robot to take, and print, photos of human subjects. The robot will, prior to taking a photo, instruct the subject(s) to move to a specific position in order to optimize the image composition.

The first half of the project, completed during the Fall 2018 semester, involved initial background research and software development, which was completed in ROS (the Robot Operating System), “a set of software libraries and tools that help [developers] build robot applications,” and rviz, ROS’s three-dimensional visualization tool. Simulated work was implemented such that the robot could detect a target and take a photo.

The second half of the project, to be completed during the Spring 2019 semester, will involve development of the robot’s hardware-software integration. This development will consist of two main steps: research into social interactions between human subjects and a human and robot photographer, and implementation of the findings from this research into the final robotic system. The timeline, along with the objectives and deliverables, are further broken down below for greater clarity.

Due to the nature of this project, the work completed will serve as a resource for future researchers interested in areas including the development of artificially intelligent cameras, human-robot interaction, and hardware-software integration.

---

**TIMELINE, SPRING 2019**

**Milestone 1 - Complete Research on Social Interactions with a Photographer**

- **Description**
  
  We will recruit groups of 2 to 4 participants to take part in the study together. A total of approximately 200 participants will be involved. We hope to recruit at least one trained
photographer per study session, although we may run sessions with inexperienced photographers if not enough trained participants sign up for the study. The study will start with a demographics survey to gather information about the participant’s age, major/occupation, prior photography experience, prior experience with robots, etc. The pre-test survey will also include a short personality questionnaire, as it is possible that people’s personality traits affect their reactions to the study manipulations.

After the demographics survey, the study will have one or two parts: a human-human interaction part and a human-robot interaction part. When they are both carried out in one study session, they will be experienced sequentially by participants with the human-human interaction part first.

The study will be audio- and video-taped and so that the human-human and human-robot interactions can be analyzed after the experiment sessions end (e.g., so that we can identify patterns of interaction and build computational models for our robot’s behaviors from the data).

● Objectives
  ○ Through the proposed study, we will collect data through audio/video recordings, surveys, and discussions to analyze the interaction process that takes place during social photo shoot events with a human (or robot) photographer. The data will inform the development of an autonomous, social robot photographer system.

● Deliverables
  ○ The collected data, in the form of recordings, surveys, and discussions, will be used to produce an analysis that will inform the development of the robot photographer’s hardware and software system.

Milestone 2 - Implement Findings from Human-Robot Interaction Study
● Objectives
  ○ To incorporate the research findings into project development.
● Deliverables
  ○ The hardware and software implementation of the robot photographer

Milestone 3 - Complete Report
● Objectives
  ○ To document the results of the project, both to serve as a formal record for those involved in the project, and also to provide a resource for those interested in similar areas of research.
● Deliverables
  ○ A research paper
Note on Deliverables: Some of the software work, developed in ROS, is very closely related to material covered in CPSC-659 Building Interactive Machines. As a result, the source code for this project will not be made available to those not involved in the development of the robot photographer.