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Facilitating Human-Robot Collaboration in a Search and Rescue Setting

I worked in Stanford's Computer Science Department in the ILIAD lab under Professor Dorsa Sadigh's guidance in the summer of 2019. The project aim was to simulate real-time, human-robot collaboration and test autonomous bots in a laboratory setting for search-and-rescue situations. Using a neural network model and three separate types of autonomous bots (Zooids), the simulation was a continuous, goal-based interaction representing (a) the human in distress or the goal (b) the robot representing the first responder trying to meet the human in distress and (c) the AI robot leading the first-responder robot towards its goal.

The purpose of the simulation was to randomize in real time the positions of the AI robot and the first-responder robot and validate whether the AI learning algorithm of the neural network model could direct the AI robot to lead the first-responder robot towards the optimal goal. This was accomplished through Python-based position and velocity algorithms interfacing with the neural network model's learning algorithm implemented in Java.

The interface of the real robots would not interact with the Python interface while the model worked in the simulation environment. This was solved by updating the Python interface launch procedure and changing the order of the path folders. It took the AI algorithm 1.5 seconds to load. This caused a lag time and thus prevented the AI robot and the first responder robot from communicating in real-time. This was solved by running the AI algorithm and position/velocity algorithm on two separate, parallel threads using Java multithreading.

Using the real Zooid bots, real-time interaction between the AI bot directing the first-responder robot to the human in distress was successfully demonstrated. This result was evaluated against a number of inputs and various degrees of guidance-factor acceptance.