Objective

Despite recent advances in the field, robots still cannot match human skills for manipulation. In order to exploit the relative strengths of robots and humans, this project proposes a human-in-the-loop system where a few human supervisors support many worker robots. Our recently developed Augmented Reality-based Human-Robot Interaction framework allows for the visualization of a variety of information such as raw sensor data, coordinate frames, task progress, 3D object models, the future path of the robot and projected text, and enables the use of natural hand gestures. This project will extend this framework into a multi-robot setting and using multi-modal communication for smoother interaction. In our setup, robots will indicate their need for help using AR and gestures if they encounter a problem they can’t solve. The human supervisor can then enter the workspace of the robot with stalled task progress, and resolve the issue by collaborating with the robot in a safe and effective manner. Using semi-autonomous order packing as a motivating scenario, this project will investigate the feasibility of the proposed few-human, many-robot setting, as well as design an interaction model with multiple communication modes including AR, speech, gaze and implicit motion cues.

Project Details

The hardware that will be used for this project includes robot arms and an AR Headset (Microsoft Hololens 2). The developed methods will be applied to two related situations: 1) A human supervisor helps any robot that experiences problems in a multi-robot scenario, and 2) One-on-one close proximity collaboration. Usability studies will be conducted to measure the subjective experience of people who use the AR interface.

Prerequisites

- Strong programming skills in Python, C++, or C#