Explainable and Verifiable Models for Human-Robot Teaming

PI: Thomas Howard, Assistant Professor of Electrical and Computer Engineering, University of Rochester

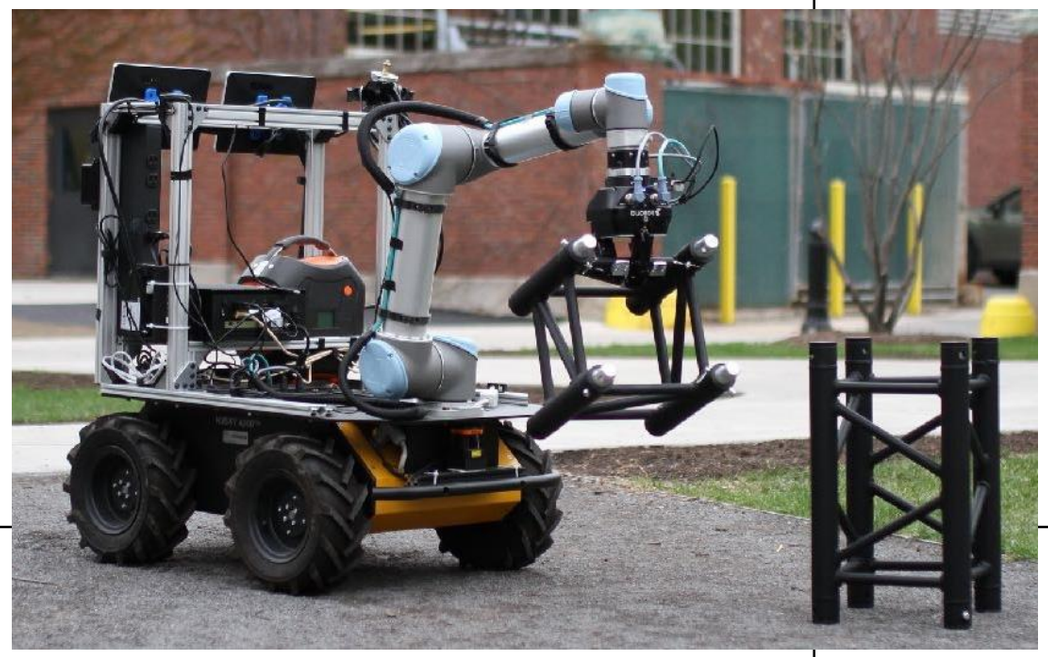

Figure 1: A collaborative human-robot assembly task where additional guidance from the operator and/or robot feedback may improve the efficiency of activities performed or be necessary to guarantee feasibility

Research Objectives

The goal of this research project is to develop algorithms and models for explainable natural language understanding and generation for bi-directional communication in collaborative human-robot teams

The innovation advances the SOA by reformulating the inference procedure of contemporary models to express bounds on the metric and semantic state of the environment

The project will seek to transition the proposed technologies from concept and formulation (TRL2) to laboratory-based experimental validation (TRL4)

Approach

Reformulate graphical model-based approaches to grounded language communication for explainable natural language understanding and generation

Engineer datasets of structured monologues and dialogues in the context of simulated environments to quantify the accuracy and efficiency of probabilistic inference and provide a suitable baseline for comparative experiments

Validate algorithms and models through simulation and physical experimentation on mobile robots, manipulators, and mobile manipulators in scenarios relevant to space exploration

Potential Impact

Improvements in the ability for robot teammates to communicate information about their current actions, past activities and/or gaps in specifications that inhibit task execution will enable robot teammates to more effectively collaborate with humans intermittently and independently to perform tasks including habitat construction, surface exploration, sample collection, and station maintenance

Advances in explainable grounded language communication will also enable terrestrial human-robot teaming applications in manufacturing, agriculture, and medicine