Intent Detection and Communication for Robots on Construction Sites

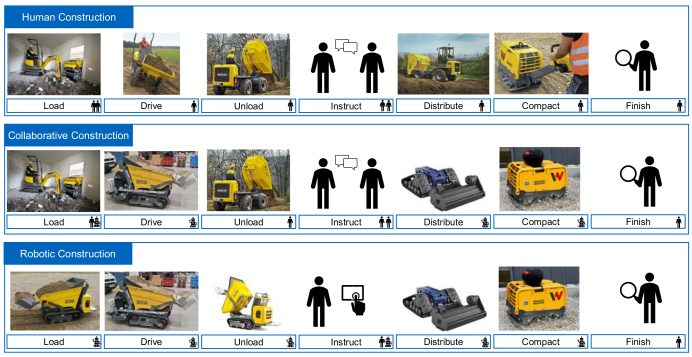

Fig. 1: Processes on construction sites operated only by humans (1), by humans and robots (2) or only by robots (3).

Background

Today's construction sites are maintained mainly by large, manually operated machinery and human workers. Many tasks are monotonous and have dangerous or harmful components for humans. Automated processes and machines have transformed production halls in the past decades. Automating machinery on construction sites, however, is considerably more difficult than in an enclosed industrial environment.

Building partially autonomous machines, which are able to interact, communicate and collaborate with humans as well as other machines is therefore a crucial step towards more autonomy on construction sites. Most approaches so far focus on homogeneous fleets of robots for a single, self-contained task. This is, however, not a realistic scenario for most construction sites in the world.

As a first step towards this goal, we therefore focus on the task of intent detection or classification. Using visual sensors, the intent of other robots or humans is classified using machine learning algorithms. Subsequently, suitable ways for communicating the intents of others or of the ego robot will be investigated. This allows the robots to share their knowledge with other robots and make collaborating humans aware of their intent, enabling a safe collaboration between humans and robots on construction sites.

Task Description

Throughout this project you will be working within our project "CoCoRo" (Collaborative Construction Robots) together with colleagues from the FML chair, located at the mechanical engineering department. The FML chair maintains a construction site lab with an excavator and a dump loader, which can be both controlled via ROS. The focus of your research will be on the intent detection and communication between these robots and humans. While the general frame for this thesis is already established, you as a student will have the opportunity to shape and influence this thesis based on your ideas and preferences.

During this project you will be

- performing a literature research on intent classification and communication,
- designing real-world scenarios for later evaluation,
- implementing machine learning algorithms for intent classification,
- designing digital/visual ways to communicate intents with other robots & humans,
- evaluating, analyzing and comparing your results as well as documenting your work.

We offer the opportunity to continue with a PhD in the same project (CoCoRo) after finishing this thesis. Students who would like to pursue a PhD in this field are therefore especially encouraged to apply.

Technical University of Munich

School of Computation, Information and Technology

Chair of Robotics, AI and Embedded Systems

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Advisor:
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Research project:
CoCoRo

Type:
Master Thesis, Guided Research

Research area:
Human-Robot/Robot-Robot collaboration, Partial Autonomy, HRI,

Programming language:
Python

Required skills:
Python, C/C++, ROS, Machine Learning, Reinforcement Learning

Language:
Englisch/German

Date of submission:
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Requirements

For a successful completion of the project you should have

- programming experience in Python or C++,
- a background in Artificial Intelligence (Machine/Deep Learning),
- some knowledge of mobile robots, ROS and visual processing methods.

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