

Master thesis:

Machine learning for semantic segmentation in a factory

The Volvo Group is one of the world's leading manufacturers of trucks, buses, construction equipment, and marine and industrial engines under the leading brands Volvo, Renault Trucks, Mack, UD Trucks, Eicher, SDLG, Terex Trucks, Prevost, Nova Bus, UD Bus, Sunwin Bus, and Volvo Penta.

Volvo Group Trucks Operations encompasses the production of state-of-the-art products for the Volvo Group's truck brands and Volvo Group engines and transmissions through an international world-class industrial environment.

With Volvo Group Trucks Operations, you will be part of a global and diverse team of highly skilled professionals working with energy, passion, and respect for the individual to become the world leader in sustainable transport solutions.

Background of the thesis project

At the final assembly line at Volvo's manufacturing plants, assembly details are provided as an assembly kit to the assembly stations. The reason is that there is not enough space for the storage of materials at each assembly station. Therefore materials are placed in a storage rack away from the assembly station but still in the vicinity. The required components for the specific product variant shall be picked by hand or by a robot from smaller bins and placed on an ATR (Autonomous Transport Robot) that takes the kit to an assembly station where components are assembled on the engine. To minimize the number of ATR types, two ATRs working together carrying larger or heavier objects. Ceiling-mounted RGB-cameras will be used to sense the environment, e.g., humans and forklifts, in which the ATRs are moving. We have built an initial demonstrator of the cameras and ATRs but would like to enhance the capabilities of the systems by including more advanced control methods that allow, for example, formation control of multiple ATRs.

In order to give the ATRs a map to navigate in, we intend to use pictures from overlapping cameras in the factory ceiling and use machine learning for semantic segmentation in order to identify the driveable area.

Suitable background

Master program in Systems, Control and Mechatronics, or similar. Courses in deep machine learning and computer vision. Interest in programming (mainly Python and PyTorch) and learning ROS (Robot Operating System).

Thesis project task

The overall goal is to maintain a real-time map of areas in the factory where ATR can navigate safely. These maps will be used, by a related project, to compute trajectories for the ATRs to follow.

Specific tasks include:

This document describes a Master Thesis to be performed at Group Trucks Operations, GTO, Göteborg, during 2021.

1. Design, implement, and evaluate a neural network for semantic segmentation of the factory floor. Images are provided by cameras mounted in the ceiling of the factory.
2. Define and update coordinates of the driveable areas.
3. Update the database, in real-time, with the data from the semantic segmentation.
4. Evaluate the approach in laboratory and factory environment.

Methodology

- Literature studies.
- Design and implement a solution in lab setting.
- Run demonstration in factory to validate the result.

Thesis Level

Master

Language

English

Starting date

January 2021

Number of students

Two (2)

Tutor

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