Master thesis: Using collaborative robots and machine learning based on synthetic data for dynamic bin picking

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 truck brands of the Volvo Group, as well as 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 thesis project
At the final assembly line in our manufacturing plants mounting details are provided as a “kit” to each mounting station. The reason for this is that there is no space for storage of materials at each assembly station. Therefore material are placed in a storage rack a bit away from the assembly station but still in the vicinity. The required components for the specific product variant are picked by hand from smaller bins and placed in a box that is manually transported to the assembly station where components are mounted on the engine variant. With the aim of improving both flexibility and working content we want to investigate if we can use collaborative robots and “generic cameras” in the ceiling together with machine learning algorithms based on CNN (Convolutional Neural Network) where the CNN is trained using synthetic data, i.e. CAD-models of the components. The use of these technologies (Cobots, cameras, CNNs trained on synthetic data) would be very valuable for the Volvo Group.

Suitable background
Students with a background in Automation/Robotics/machine learning and/or computer vision. Knowledge in the Robot Operating System, ROS, is required. Programming knowledge in Python/C++.

Thesis project task
In parallel with another master thesis, detect, classify and identify pose and position of advanced components in a bin using 3D/6D CNN. Use the pose and position information having a cobot to pick and place the components.

This project requires both good theoretical and “hands-on” skills and a genuine interest in the technology.

This thesis will be a part of the research projects Unification and Caramba where both Chalmers and Örebro University are involved.
This document describes a Master Thesis to be performed at Group Trucks Operations, GTO, Göteborg, during 2019.

**Methodology**
- Study earlier thesis work and literature for training/usage of CNNs and robot programming using ROS.
- Design and calibrate a camera system set-up
- Use/develop algorithms for robust component detection
- Make a system implementation for the bin picking using a robotic arm
- Run demonstration to validate the result

**Thesis Level**
Master

**Language**
Thesis is to be written in English.

**Starting date**
January 2018

**Number of students**
Two (2)

**Tutor**
Assistant professor Yiannis Karayiannidis, Chalmers, dept. E2
Collaborative Robot System manager Per-Lage Götvall, Volvo GTO, R&TD