

Master thesis: Using synthetic data and CNNs for dynamic quality inspection

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. To increase quality we want to use "generic cameras" in the ceiling together with a CNN (Convolutional Neural Network) where the CNN is trained on synthetic data, i.e. CAD-models of the components. If it is possible to use these technologies (generic cameras, CNNs trained on synthetic data) it would be very valuable for the Volvo Group.

Suitable background

Automation & Mechatronics (M/Z/F).

Thesis project task

The idea is to replicate research results from Chalmers (<https://arxiv.org/pdf/2005.06262.pdf>) and extend the number of cameras and views. For a selection of various Volvo components, use their CAD data to train the CNN. Define camera type, number of cameras, positions etc. for a physical installation. Make a SW system that can identify whether or not the details are mounted and in the correct position.

This project requires both good theoretical skills as well as the ability to make the system "come real".

This thesis will be a part of the research project Vimcore, a joint Chalmers – Volvo Group project within the frame of CHAIR.

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

Methodology

- Literature studies.
- Train a network on the Volvo Components (CAD-models)
- Design, calculate and realize a camera system set-up in a lab environment or at the main assembly line in Skövde (depending on progress)
- Develop algorithms for robust component detection (preferable on a general level)
- Make a system implementation for the quality inspection
- Run demonstration to validate the result

Thesis Level

Master

Language

Thesis is to be written in English.

Starting date

January 2020

Number of students

Two (2)

Tutor

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