



Denso Sweden

Master thesis

Proposal 2020

Gothenburg

Denso is the world's second largest mobility supplier. The information and safety systems business group develops and manufactures ITS (Intelligent Transport System) products such as car navigation and ETC (Electronic Toll Collection) systems; telematics products; driving control and safety products (airbags sensors and ECUs); body electronics and meters.

Background

Object detection is a vital part of perception systems of Autonomous Driving (AD) and Advanced Driver Assistance Systems (ADAS) functionality, because an understanding of the surrounding environment is crucial for automated decision making. The perception systems rely on data from several different sensors, such as cameras, automotive radars, and lidars. In this project the focus is on how to fuse the data from lidar and camera and the data from radar and camera on detection and pixel level. The idea is to cluster detections in the lidar or radar point cloud together with pixels from the camera for those detections and pixels that belong to the same object.

Typically, the point cloud data from the lidar or radar sensors is clustered such that each cluster represents measurements of one object. Clustering methods are often heuristic methods that need to be hand-crafted to handle many different classes of objects. Recent research has shown that a better way of doing it is by training a deep learning detector that, given a point cloud, detects objects and possibly their respective classes. The classification of the objects is of importance for several different things, for example determining an appropriate dynamic model to predict its movement. We would like to replace the heuristic clustering method with a deep learning detector so that the deep learning detector will output clustered detections for radar or lidar and clustered pixels for the camera. Deep learning detectors that cluster detections or pixels are common in recent research. Though, here we want to research how to fuse this information to obtain the best performance of clustered detections and pixels.

Project descriptions:

- Based on previous work, select a CNN network structure suitable for object detection for lidar sensor data.
- Based on previous work, select a CNN network structure suitable for object detection for camera sensor data.
- Formulate a fusion 1-3 Fusion concepts for fusion of lidar CNN and camera CNN.
- Decide labeling training and strategies.
- Train network using publicly available data, such as the Nuscenes data set, and the Kitti data set.
- Compare performance of independent lidar and camera detectors to the fusion approach.

Requirements:

- Programming: Python, MATLAB, C++ is a merit.
- Knowledge of deep neural networks, especially CNNs.
- Knowledge of Bayesian estimation, e.g., Kalman filters.
- It is beneficial if you have studied the courses “Sensor Fusion and Non-Linear Filtering” and “Deep Machine Learning”.

General:

- Duration: 30 ECTS.
- Start: January 2021, or earlier if desired.
- This is a 2 student project.

Contact: Please email your interest to Karl-Magnus Dahlén: k.dahlen@eu.denso.com and/or Christopher Lindberg: c.lindberg@eu.denso.com

We look forward to your application!
