

Automated and Connected Driving Challenges

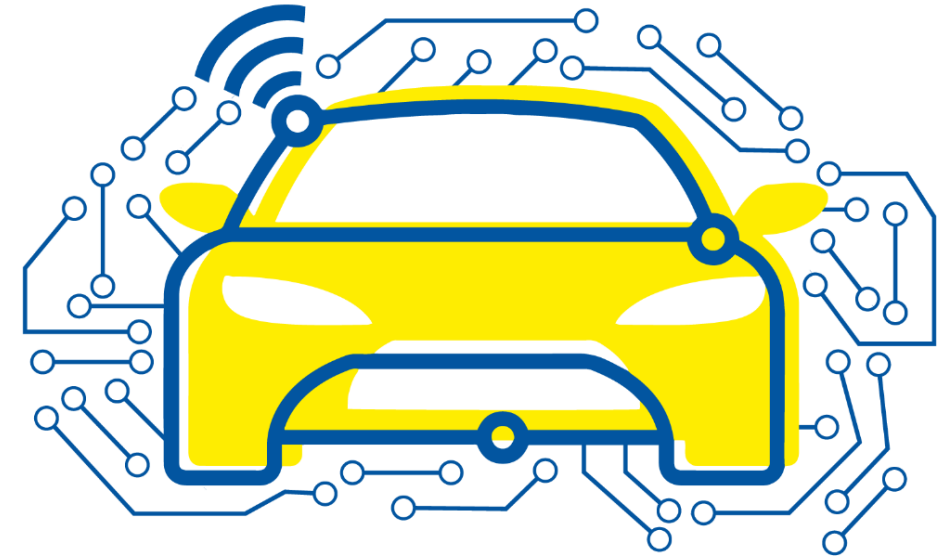
Section 2 – Sensor Data Processing

Introduction

Tasks in Section 2

Bastian Lampe

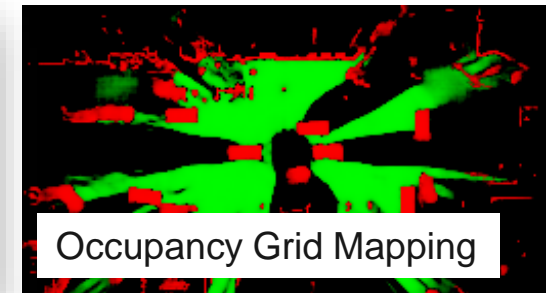
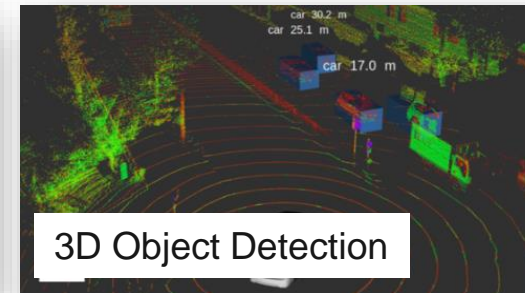
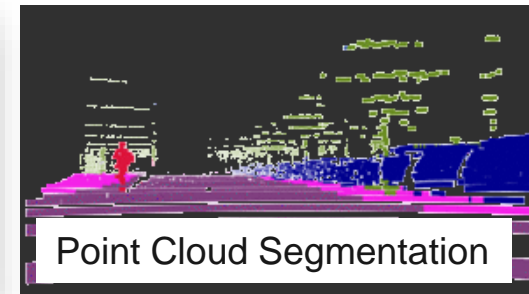
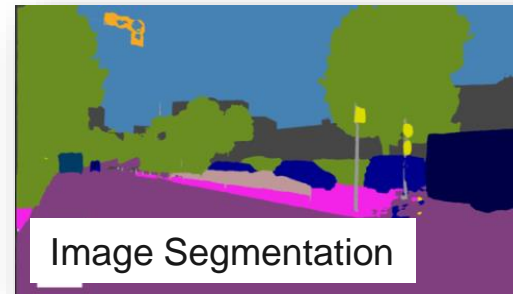
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Introduction – Tasks in Section 2

Task Overview



Single Object

Multiple Objects



Introduction – Tasks in Section 2

Semantic Segmentation of Camera Images

- **Loading a dataset** for semantic image segmentation
- **Conversion** between different **label encodings** of segmented images
- **Creation** of a **TensorFlow** input pipeline
- **Design** of a **deep learning model** for semantic image segmentation
- **Training** a model and performing **inference**
- **Implementation** of **augmentation methods** and an **augmentation policy**
- **Comparison of two models** – original dataset vs augmented dataset
- **Integration** into **ROS software stack**

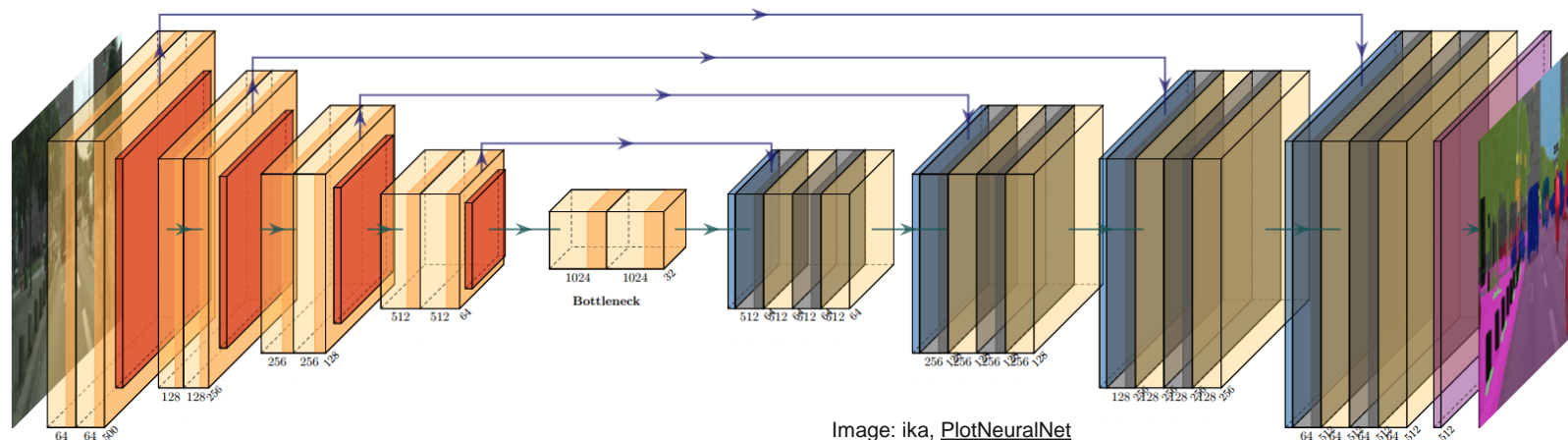


Image: Cityscapes

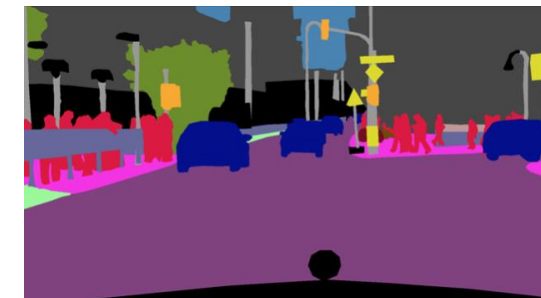


Image: Cityscapes



Introduction – Tasks in Section 2

Semantic Segmentation of Lidar Point Clouds

- **Loading a dataset** for semantic point cloud segmentation
- **Visualization** of segmented point clouds
- **Training** a neural network for point cloud segmentation
- **Performing inference** with a trained model
- Implementation of **augmentations** for lidar point clouds
- Implementation of improved **loss function**, the **focal loss**
- **Integration into ROS software stack**



Image: ika

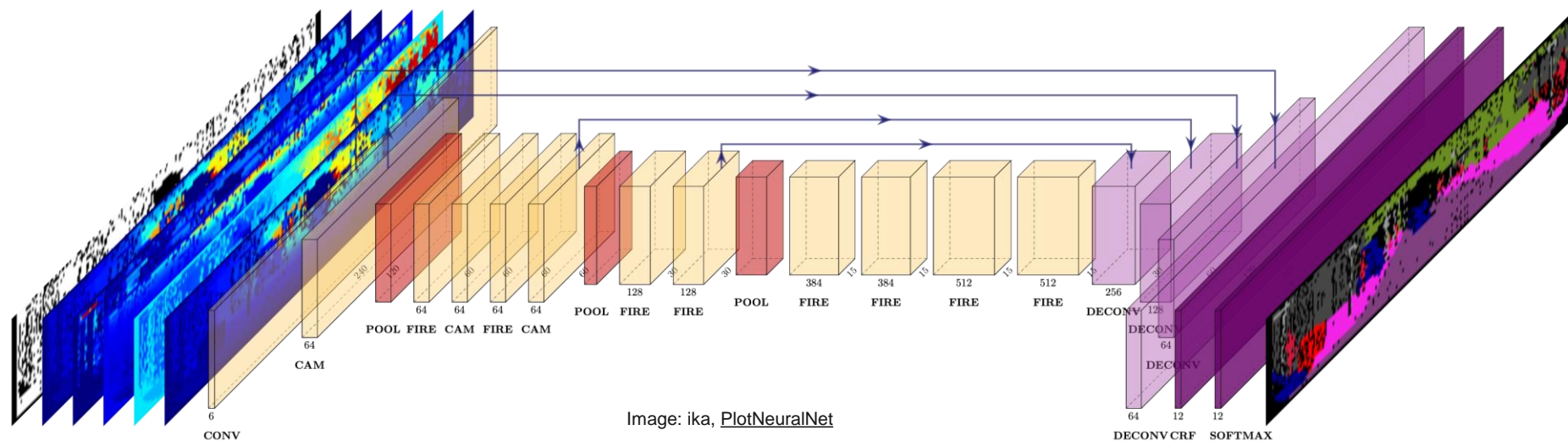


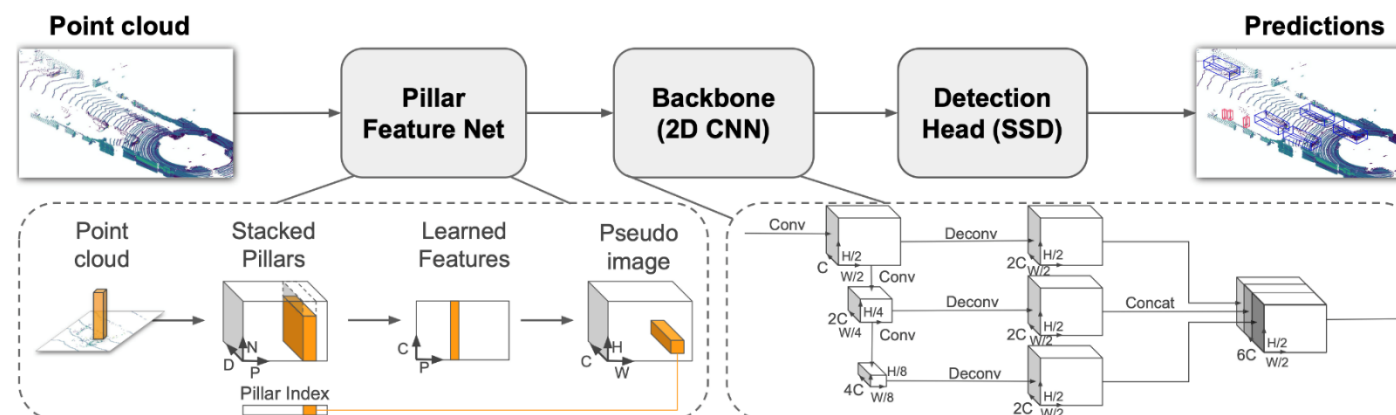
Image: ika, [PlotNeuralNet](#)



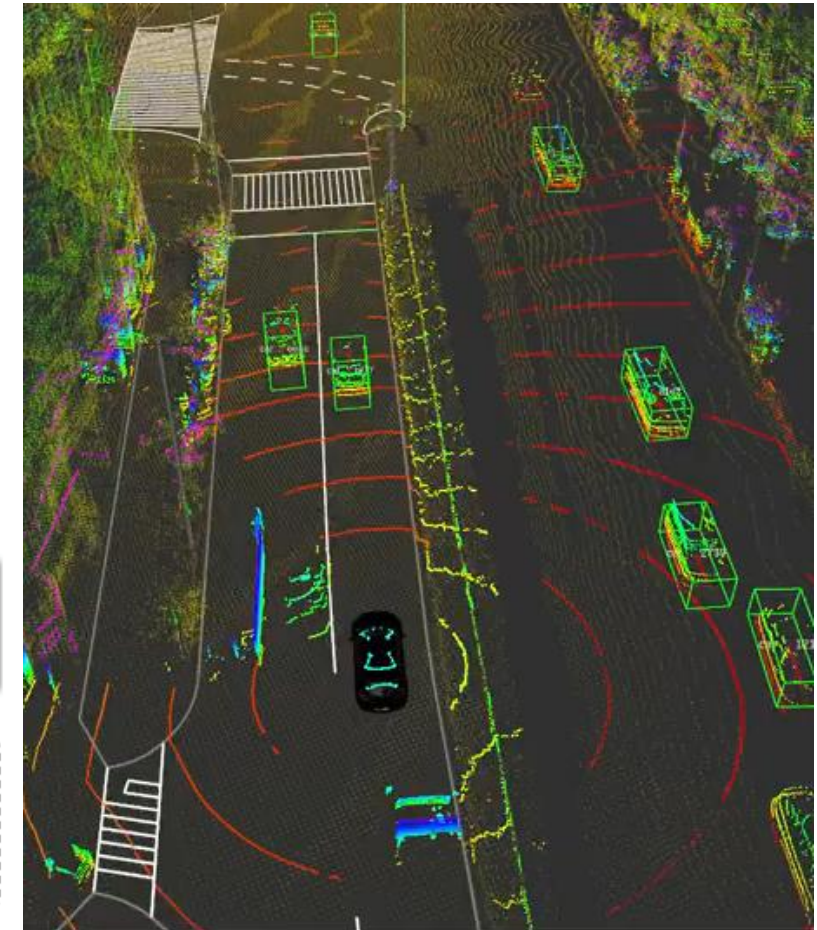
Introduction – Tasks in Section 2

3D Lidar Object Detection

- **Loading** a dataset for 3D object detection
- **Visualizing and analyzing** of input point clouds and labels
- Design of a **TensorFlow** 3D Object Detection **model architecture**
- **Configuration** of training **hyperparameters**
- **Training** of the model and **inference** on new data
- **Integration** into **ROS software stack**



Source: [Lang et al. 2019](#)



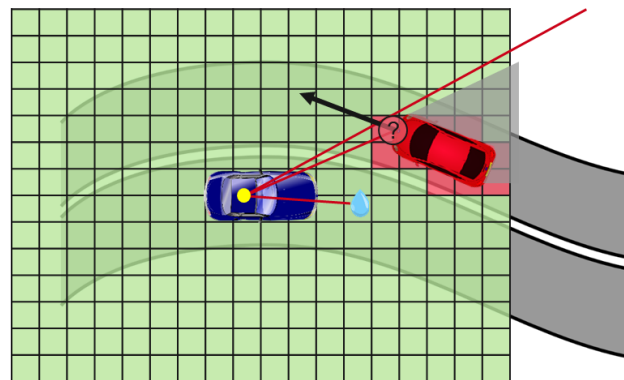
Video: Yukihiro Saito on [youtube](#)



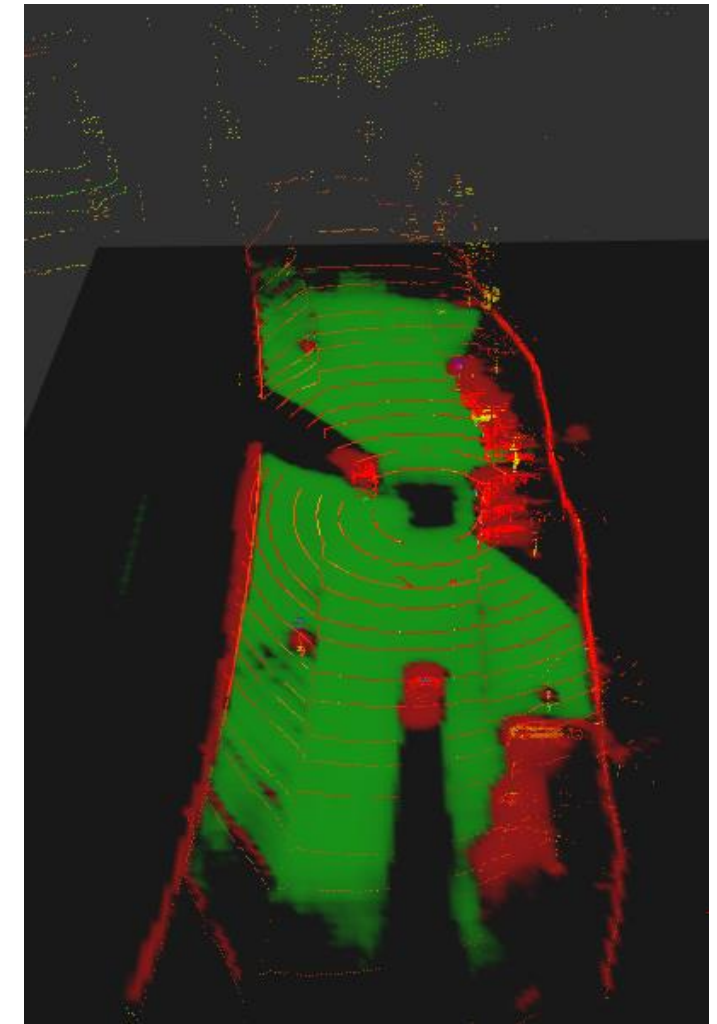
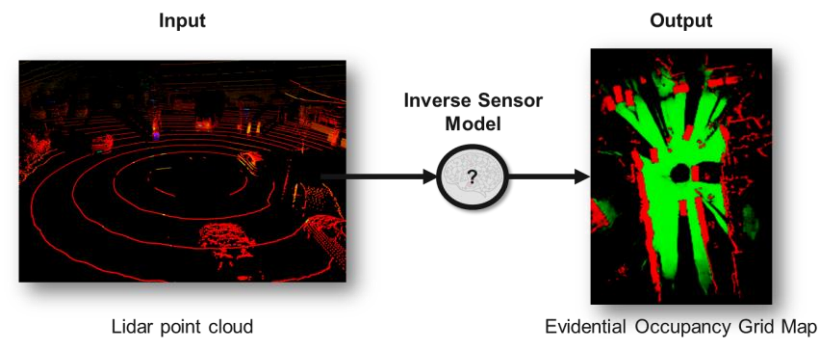
Introduction – Tasks in Section 2

Point Cloud Occupancy Grid Mapping

- **Filtering point clouds** using the PointCloudLibrary in ROS
- **Programming** a geometry-based grid mapping algorithm
- **Adapting** an existing neural network architecture for grid mapping
- **Loading and inspecting** a ready-to-use TensorFlow dataset
- **Analyzing** the training progress
- **Using** the grid_map library in the ROS framework



Simplified occupancy grid map



Images: ika



Introduction – Tasks in Section 2

Camera-based Semantic Grid Mapping

- **Create** a 360° surround view from multiple cameras
- **Compute** image transformations based on calibrated cameras
- **Apply** transformations to segmented images
- **Integrate** Inverse Perspective Mapping into a ROS Node
- **Generate** live semantic grid maps

