Exercise Session
CIVIL-459
Spring 2025
HW2

EPFL
School of Civil Engineering
Prof. Alexandre Alahi

Homework 2 - Object Detection For autonomous Driving

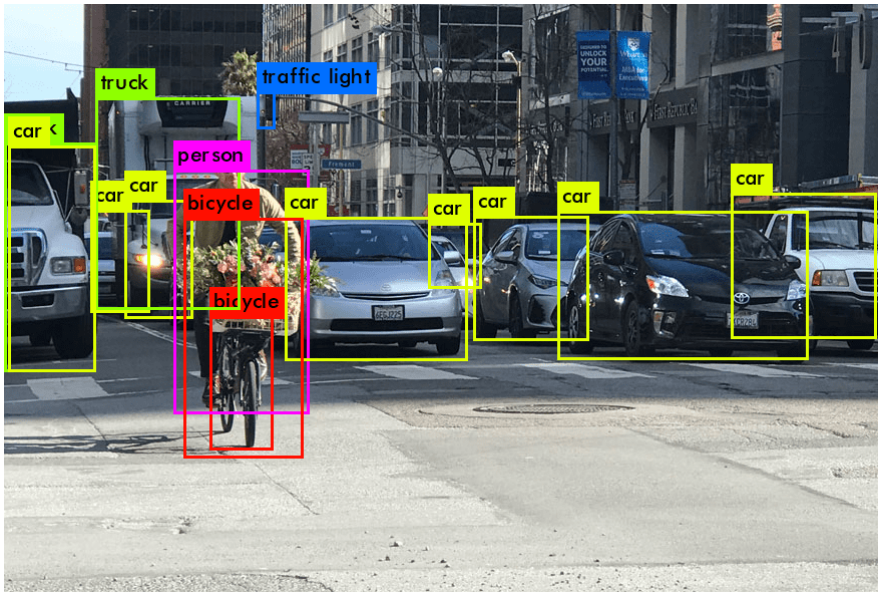

Figure 1: Object detection for autonomous driving

This time we will make use of known models and apply it to a perception task in autonomous driving which is object detection. Object detection enables the perception and understanding of objects in the surrounding by identifying them and their location in the scene. The goal is to detect objects in the scene and label each box with its identifying class. For this assignment, we will focus on three main classes: Cars, Pedestrian, Cyclistis. Object detection models have different architectures and different design objectives. Models like YOLO (You Only Look Once) prioritize real-time performance by using a single-stage, unified architecture that processes the entire image in one pass. In contrast, two-stage detectors like Faster R-CNN focus more on accuracy by generating region proposals before classifying objects, often at the cost of slower inference speeds.

What to do

Understand the architecture of YOLO and finetune it on Kitti dataset which is a common driving dataset. (You can get the notebook from "https://github.com/vita-epfl/DLAV-2025" or on Moodle). There are several theory questions about the YOLO architecture and performance accounting for 40% of the grade of the assessment.

1. Load YOLOv11 model and finetune it on the Kitti dataset.

2. Visualize the training losses and metrics on the validation set.
3. Visualize the confusion matrix.
4. Run inference and visualize some images with their bounding boxes and class labels.

Deliverables

You need to submit the jupyter notebooks containing the code and answers to theory questions and the trained models into the moodle.

Helpful References

- Yolo Documentation: https://docs.ultralytics.com/modes/train/#train-settings
- Yolo Tutorial: https://docs.ultralytics.com/guides/
- KITTI Dataset : https://www.cvlibs.net/datasets/kitti/index.php