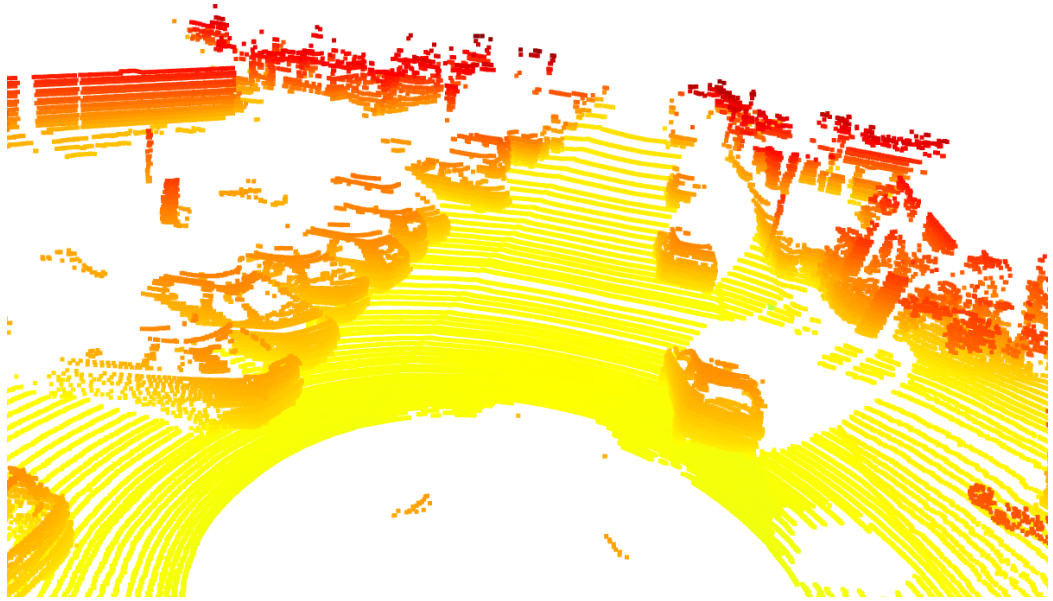
Name: Mórocz László András, BSc student, second year

Project type: laboratory project

Topic: Object recognition using LiDAR point clouds

Supervisors: Dr. Balázs Bánhelyi

- Autonomous vehicles must recognize their environment as precisely as possible
- Vehicles needs to detect obstacles, cars, cyclists and pedestrians
- With the variety of traffic, anything can happen on a public road, so edge cases are needed to be considered during development
- The LiDAR sensor performs well in poor weather conditions and even in difficult visibility, unlike cameras



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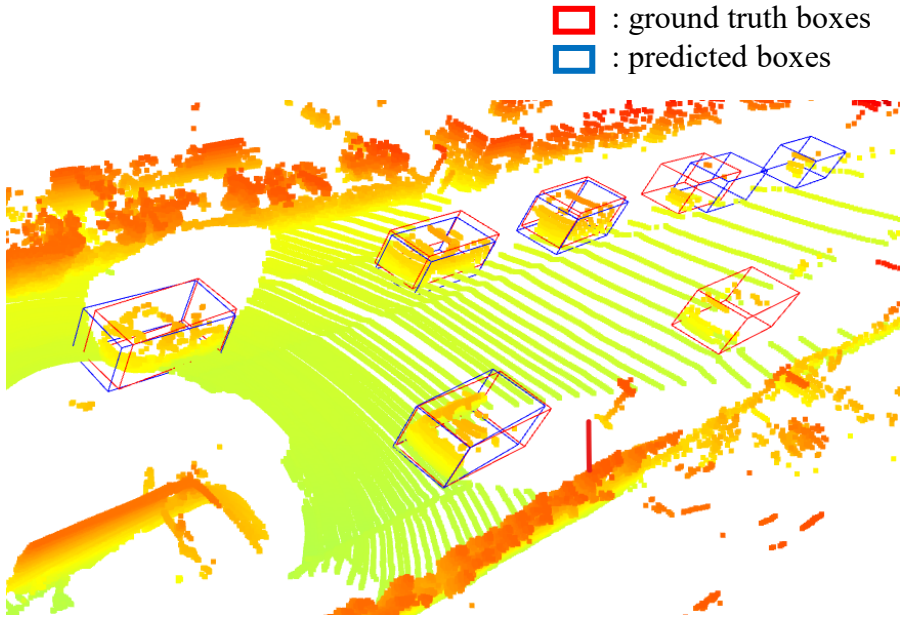
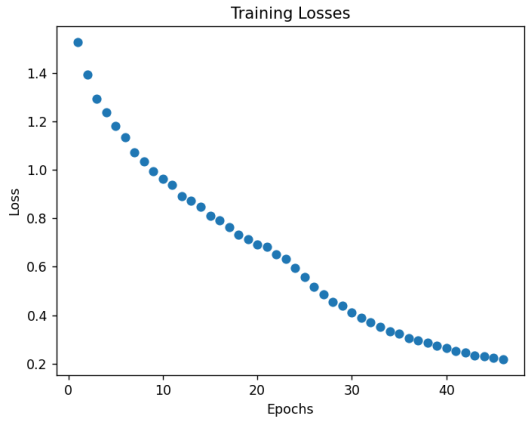
Implementation, results

- Working with industry-standard KITTI-dataset (15k+ samples)
- Built end-to-end LiDAR processing pipeline using PyTorch
- Implemented a modified PointPillars architecture to improve feature representation:
  - Added 3 new features: delta intensity, mean intensity, and point count per pillar.
  - This allows the model to better distinguish object edges and surface densities
- Established baseline performance with optimization potential

- Baseline Training Results:
  F1 score of 0.543 in the car class @ 0.7 IoU ;
  mAP score of 0.477 in the car class @ 0.7 IoU





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Next steps, future work

Next steps

- Augmenting the dataset for better yaw detections
- Using PCA for postprocessing

Future work

- Working on sensor fusion (LiDAR + camera + radar)
- Optimizing the code to enable real-time use
- Training the model for edge cases with simulated data from Carla

LiDAR

+

Camera

Higher accuracy
Better reliability

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