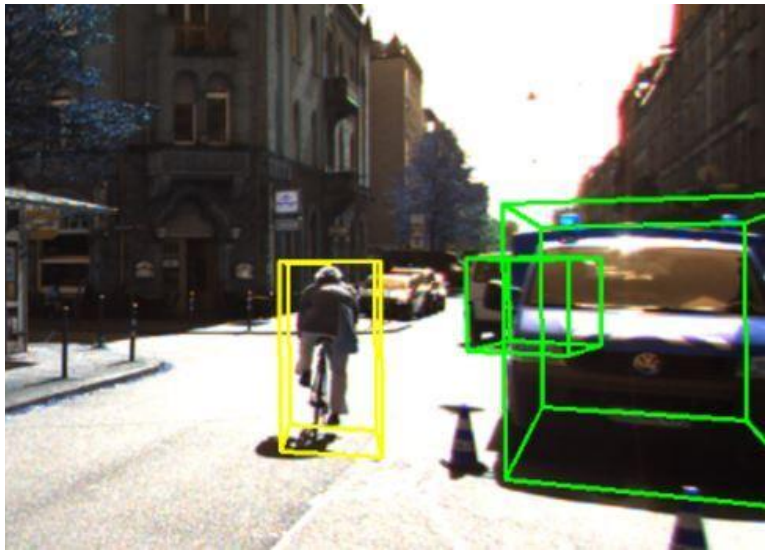
3D Car Object Detection in the KITTI Benchmark Dataset

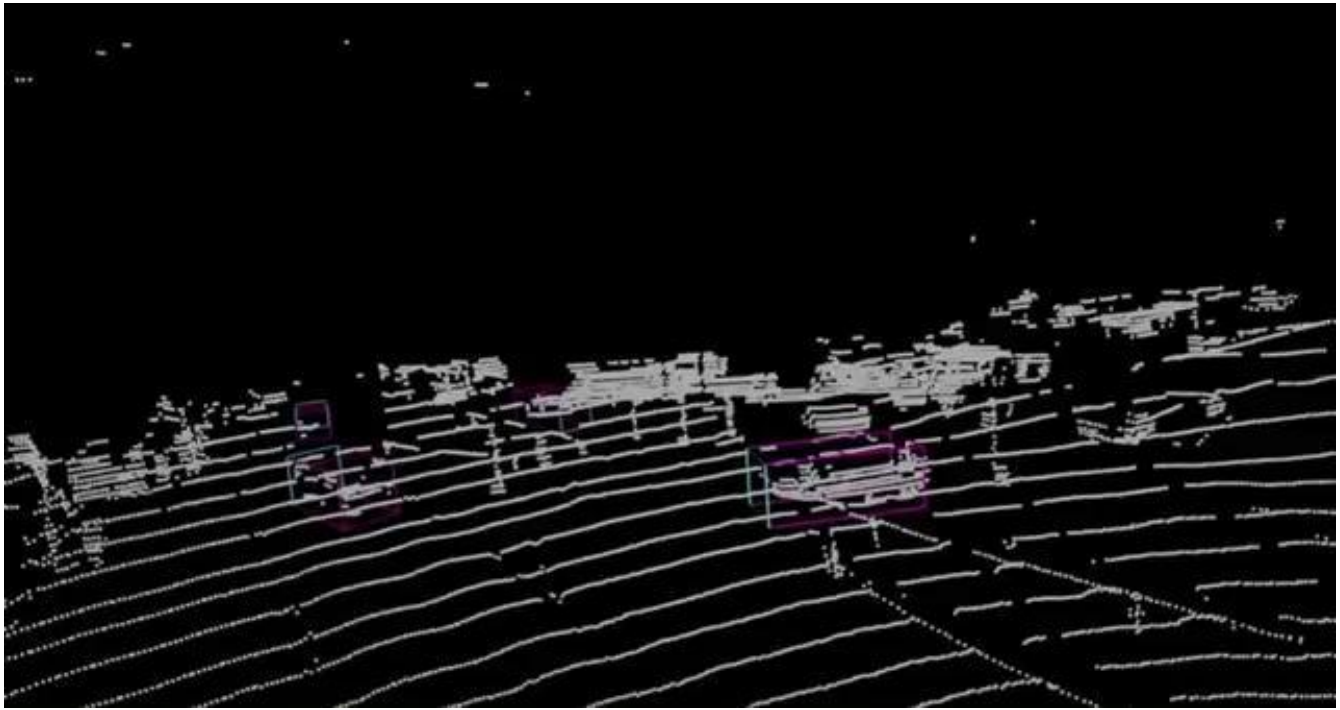
3D Object Detection

3D Object Detection Task

- Regression: determine 3d bounding box location
- Classification: classify object within box

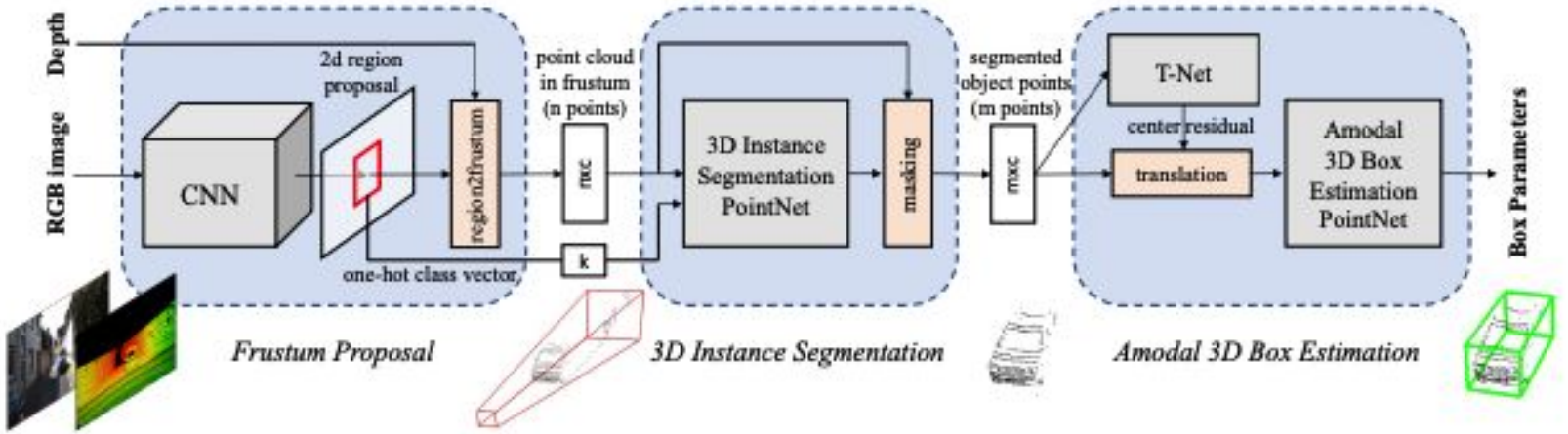


Demo



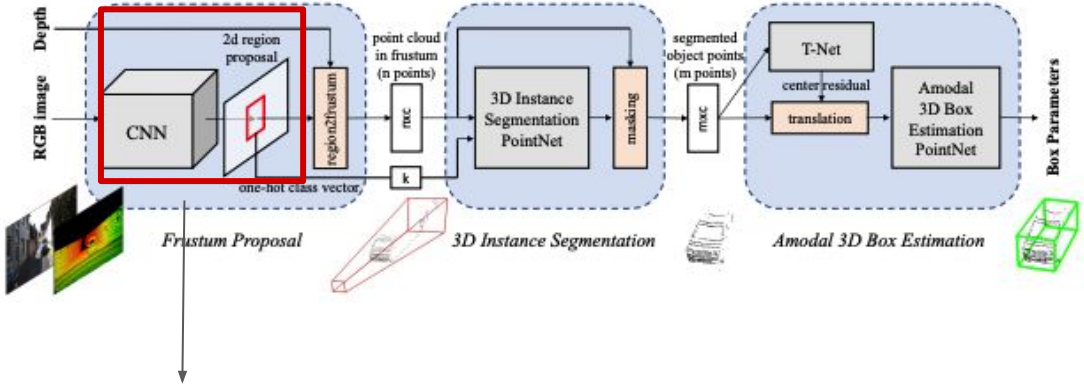
Frustrum PointNets*

Baseline model



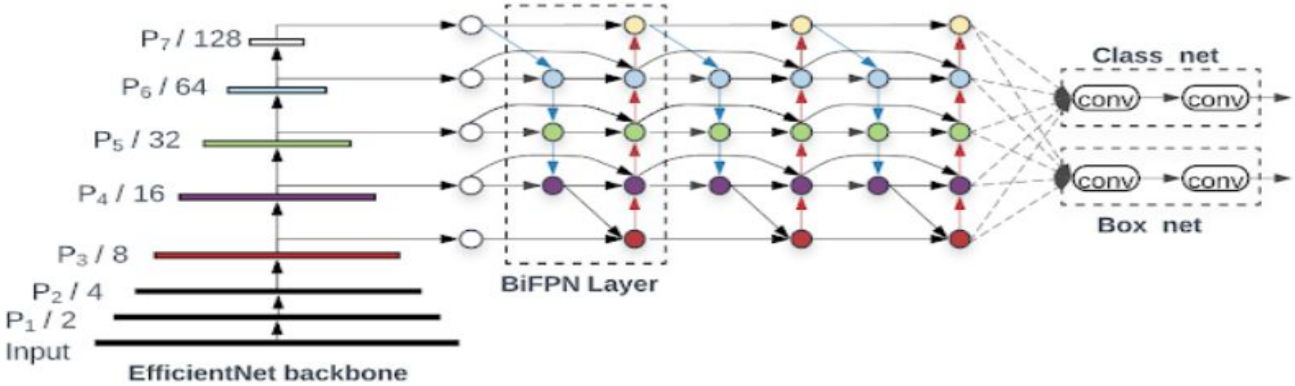
*[Qi, et al,. 2018]

Replaced faster RCNN with EfficientDet

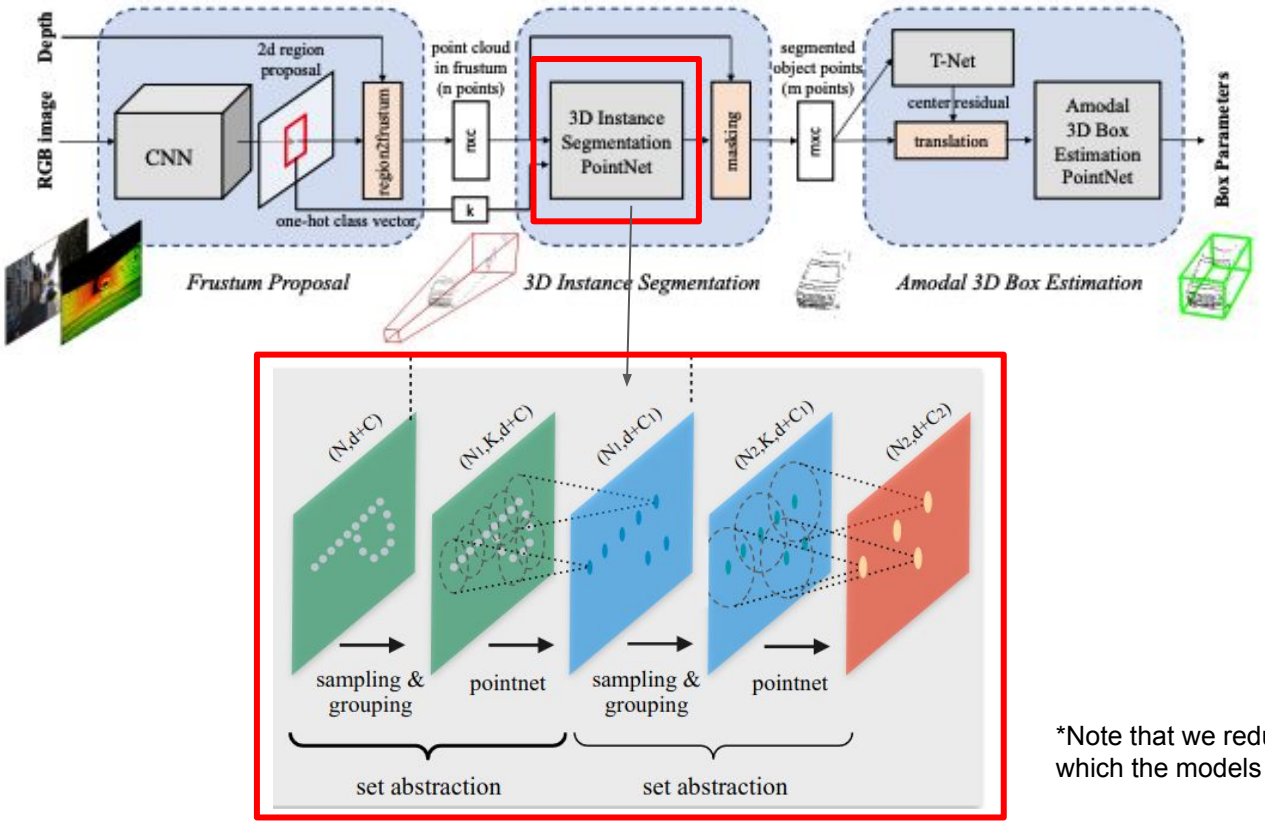


Average Precision Percentage on KITTI full val

Method	FCN	ED+FPN
Easy	83.76	**81.34**
Mod.	70.92	**60.67**
Hard	63.65	**58.06**



PointNet to ~PointNet++ in 3D Instance Seg*



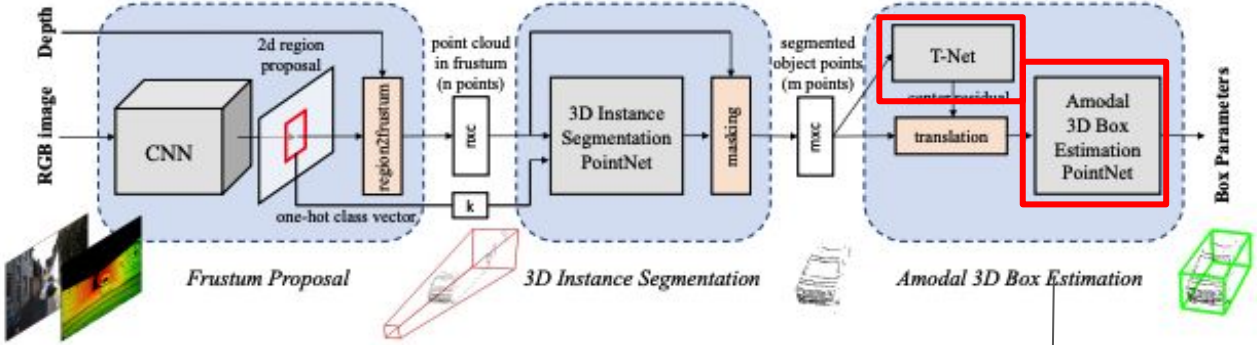
Classification accuracy: 0.8576
Loss : 2.23

Average Precision Percentage

Method	FPN*	FP++N*
Easy	36.34	26.72
Mod.	31.54	23.59
Hard	29.6	25.83

*Note that we reduced the data size and number of epochs for which the models are trained

Changed the Fully Connected Layers for BB est.



Classification accuracy: 87.15
Loss : 1.72

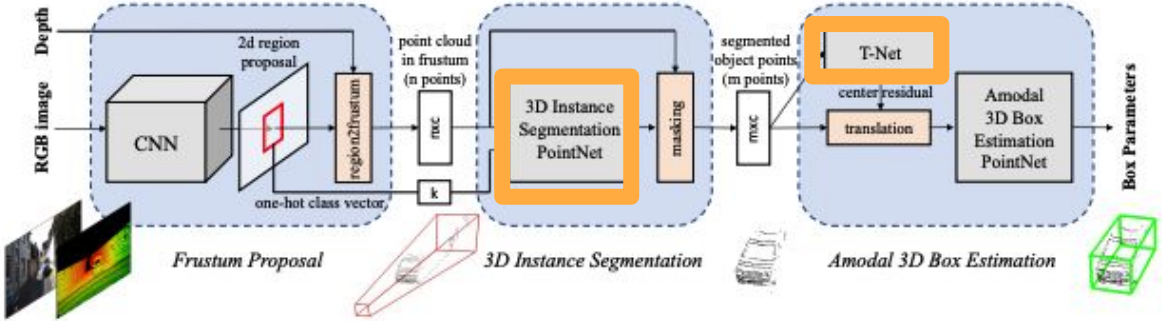
Average Precision Percentage

Method	FPN*	FPN+FC*
Easy	36.34	**32.12**
Mod.	31.54	**29.02**
Hard	29.6	**24.2**

Added additional fully connected layers.

Modified Frustrum PointNets of Full KITTI dataset

Architecture overview



Batch Norm removed in orange sections

Results

Table 1. **3D Object Detection Average Precision Percentage** KITTI Full val Dataset (cars only)

Method	Easy	Moderate	Hard
Frustrum [1]	83.76	70.92	63.65
Modified Frustrum [2]	**84.89**	**73.61**	**70.32**

[1] (Qi et al., 2018) [2] (Gustafsson & Linder-Norén, 2018)

Frustrum PointNet Truncated Training

Architecture overview

Dropout for (2.), (4.) applied in orange sections

Table 1. **Truncated Training Results** KITTI Full Validation Dataset (cars only)

Model	Segmentation Accuracy (%)	Bounding Box IoU	Box Estimation Accuracy (%)
Frustrum baseline[1]	87.29	0.715214/0.656532	56.48
(A.) Droput added in ISeg	87.36	0.714380/0.651353	55.63
(B.) Baseline SGD+Momentum	83.78	0.671862/0.618743	53.75
(C.) Dropout in Iseg and SGD+Momentum	85.66	0.693844/0.636761	53.75

[1] (simon3dv, 2020)

Thank You