Point Cloud Instance Segmentation

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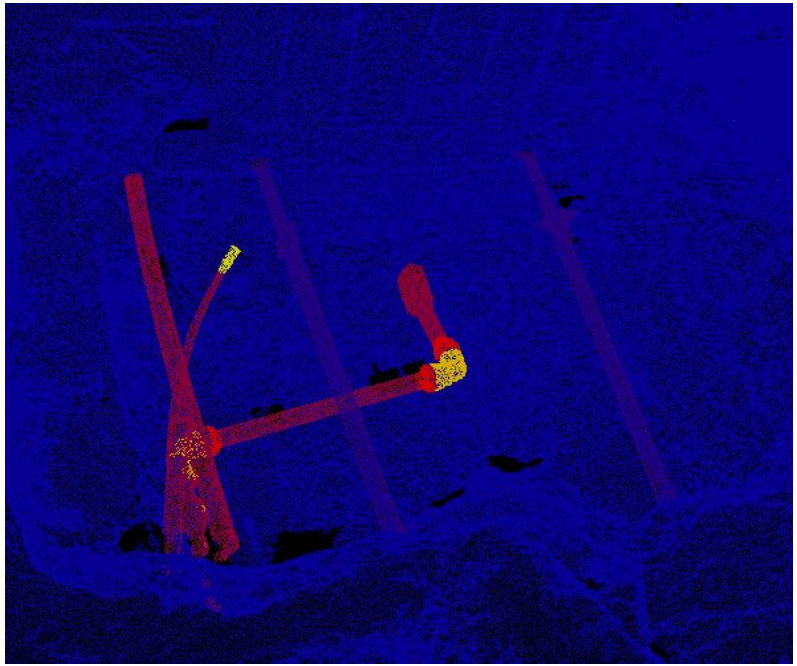
Intro

1. The goal
2. The challenge
3. Solution
4. Overview

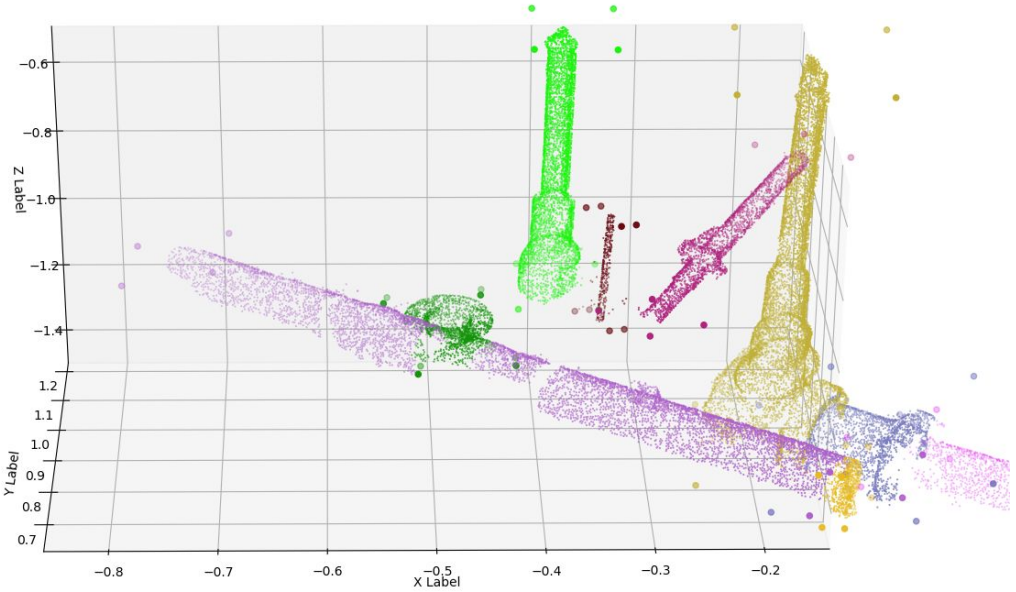
The Data



Data Cleaning and labeling

Steps:

1. Normalizing
2. Separating classes
3. Clustering (DBSCAN)
4. Bboxes (PCA)

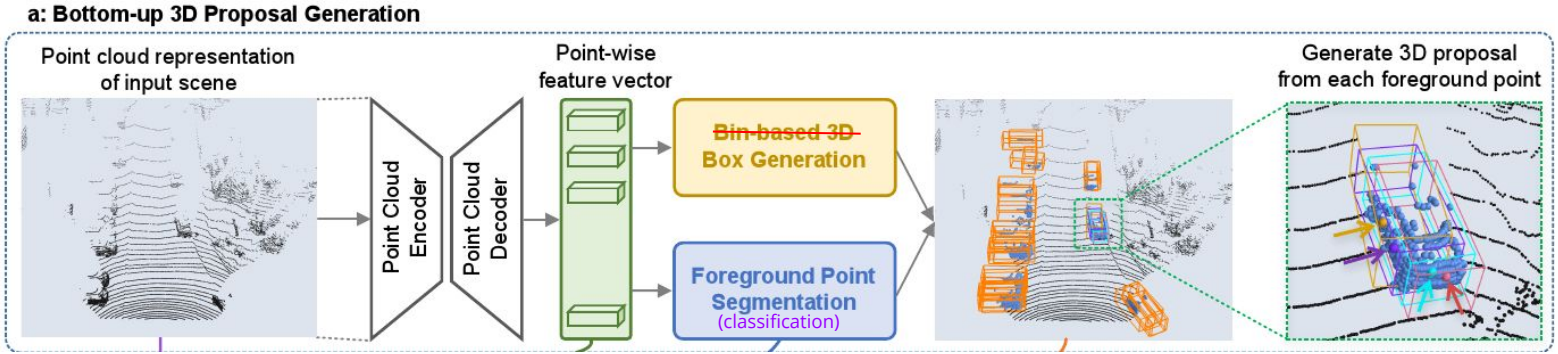


Sampling The Lidar Point Cloud

- Sampled viewpoints
- The orientation of photos used
- Average of location and orientation (Average viewpoints)
- More than 6000 scenes

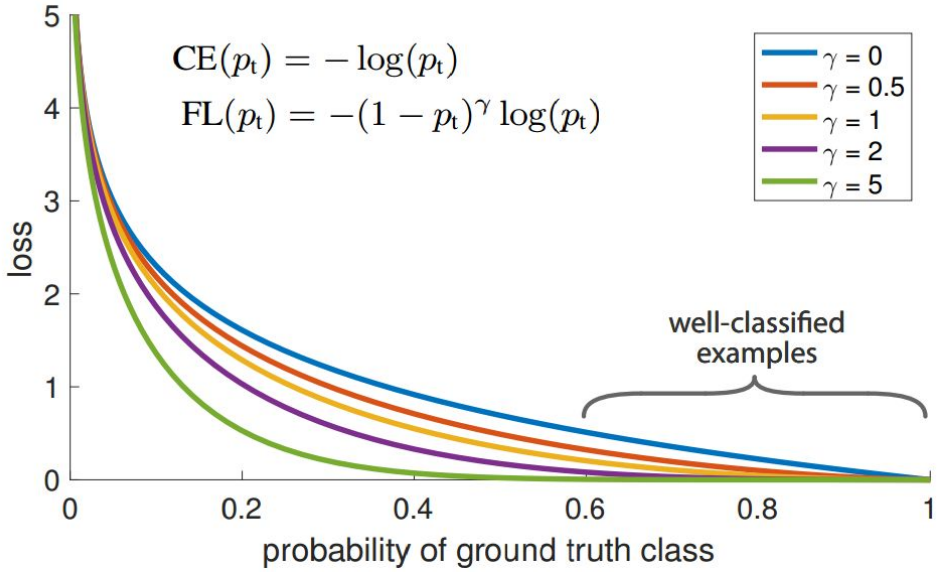
The network

- Data augmentation
- Alternative bbox representation
- Only pipe vs non-pipe points
- Pointnet++
- Focal loss

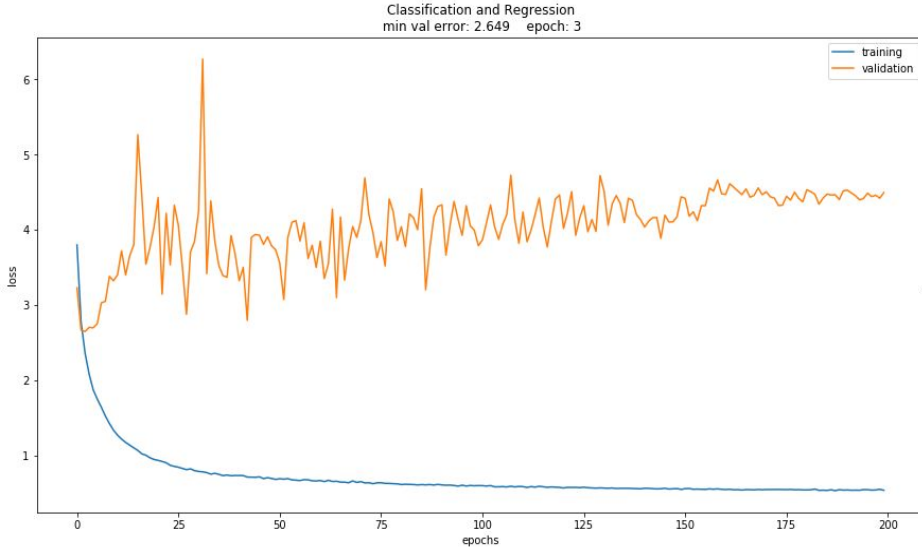


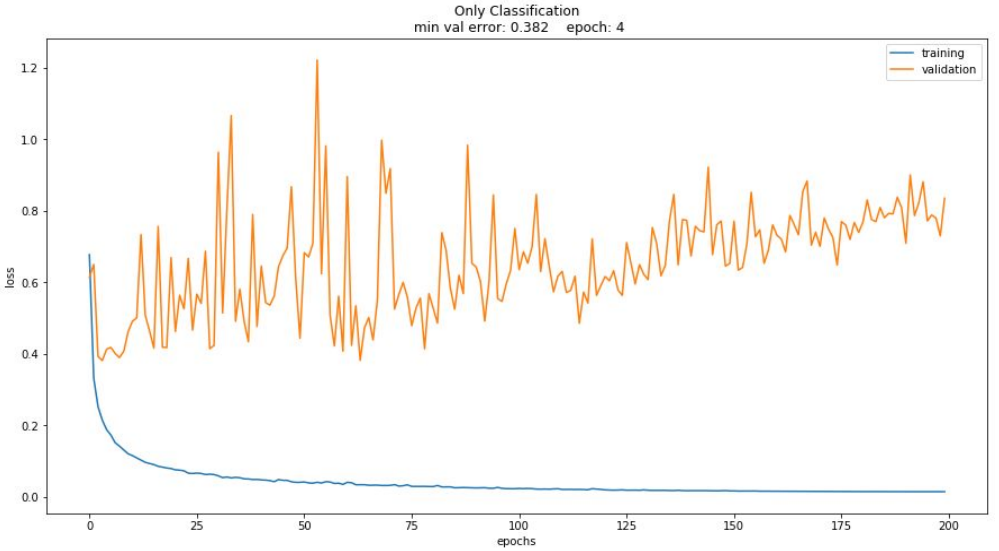
$$\mathcal{L}_{\text{focal}}(p_t) = -\alpha_t(1-p_t)^{\gamma}\log(p_t),$$

$$\text{where } p_t = \begin{cases} p & \text{for forground point} \quad y=1 \\ 1-p & \text{otherwise} \quad y=0 \end{cases}$$



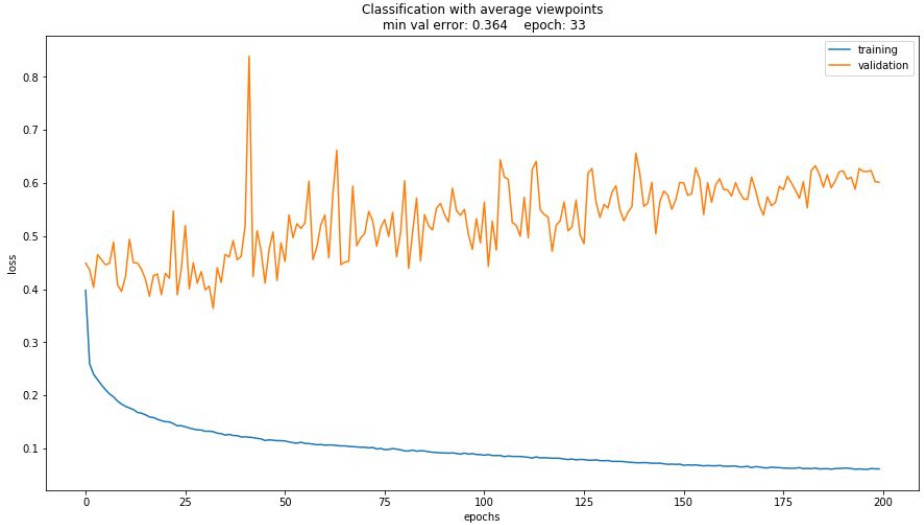
Results 1

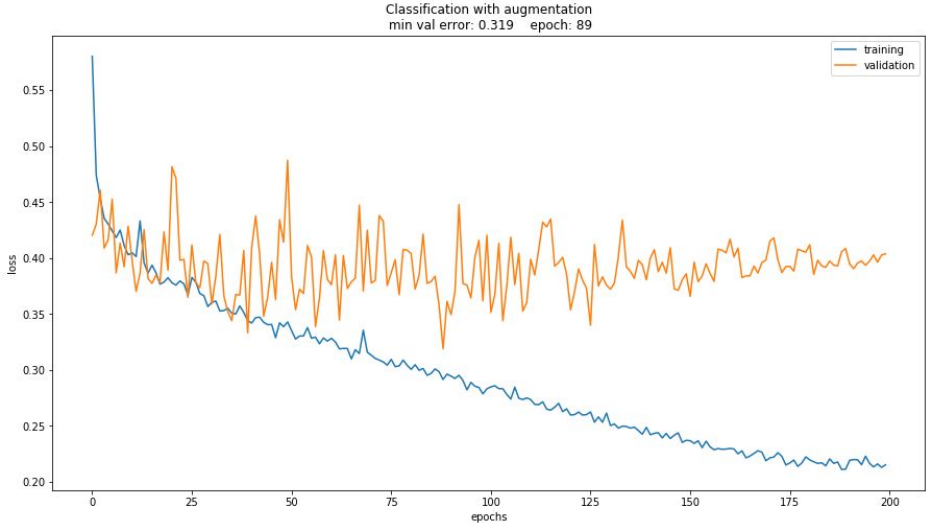




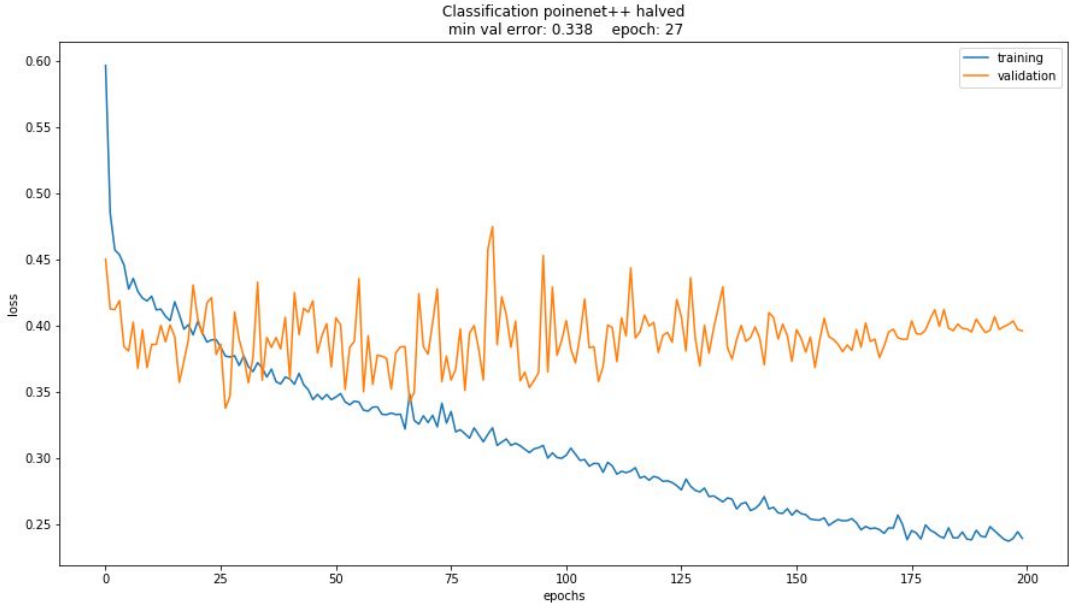
Training set: jussy1/2/3, athenaz and tram.
Validation set: plan_ouates and champel.

Results 2


Classification with average viewpoints
min val error: 0.364 epoch: 33
training
validation
loss
epochs
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
25
50
75
100
125
150
175
200


Classification with augmentation
min val error: 0.319 epoch: 89
training
validation
loss
epochs
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0
25
50
75
100
125
150
175
200

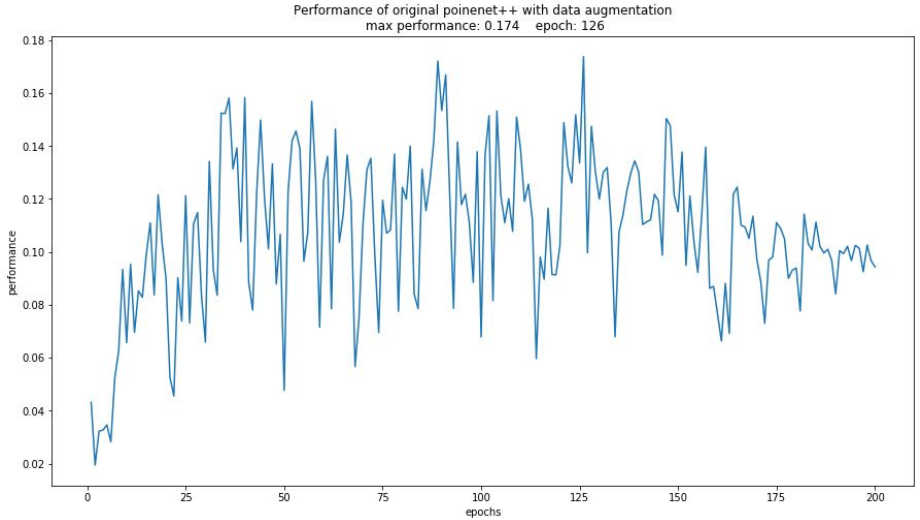
Results 3

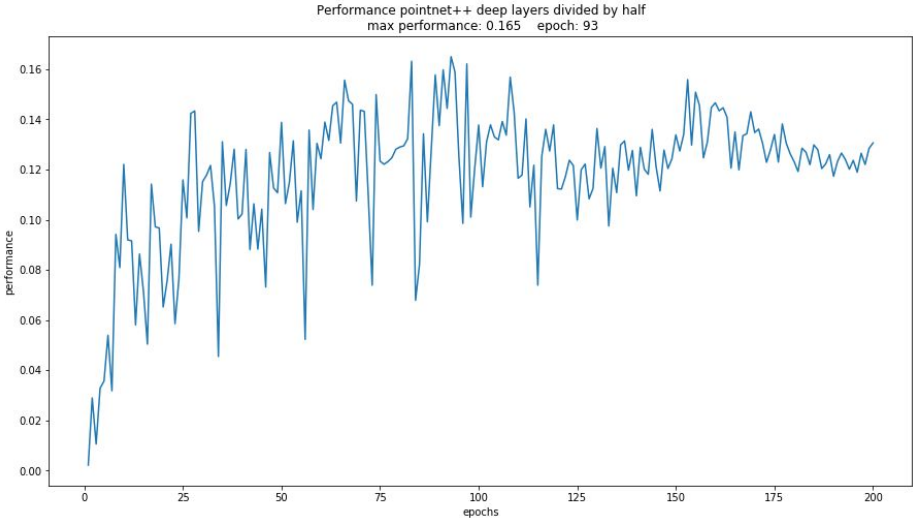

Classification poinenet++ halved
min val error: 0.338 epoch: 27
training
validation
loss
epochs
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0
25
50
75
100
125
150
175
200

Results 4

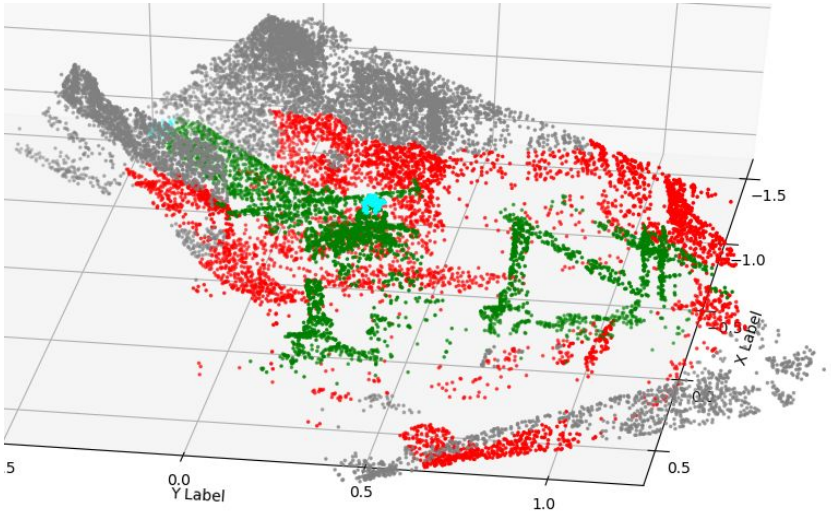
Performance :

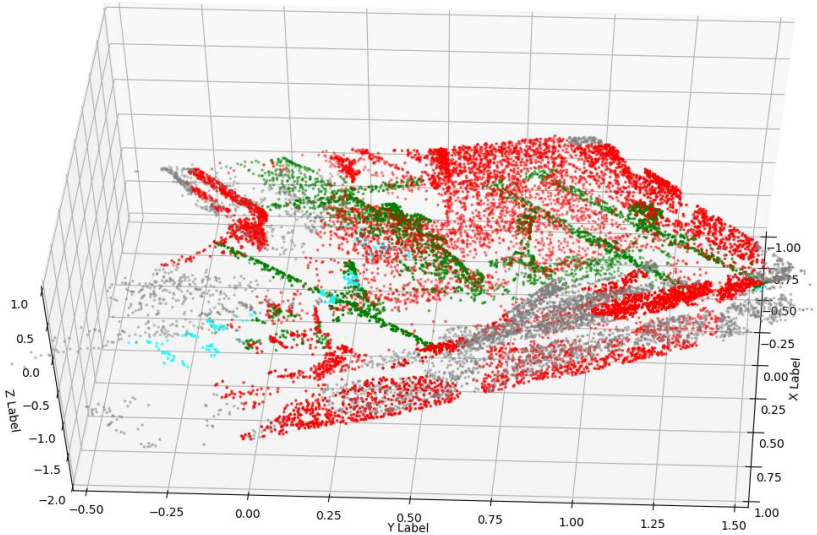
$$\frac{TruePositive}{TruePositive + FalsePositive + FalseNegative}$$

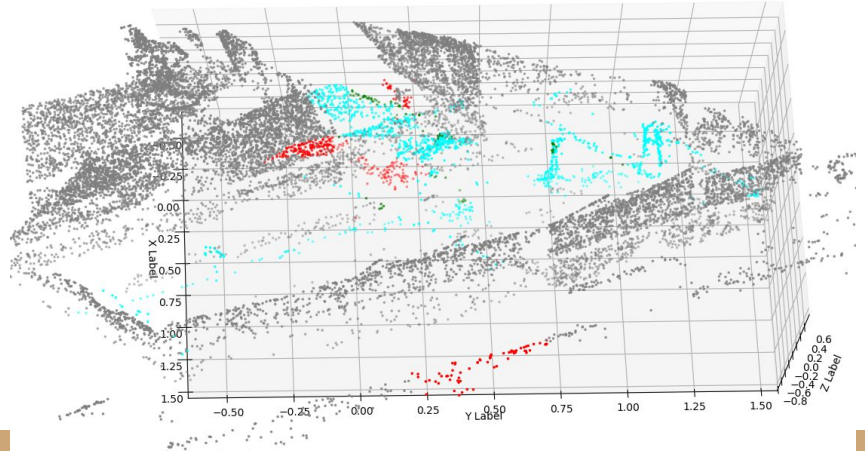




Results 5 (classification viz)

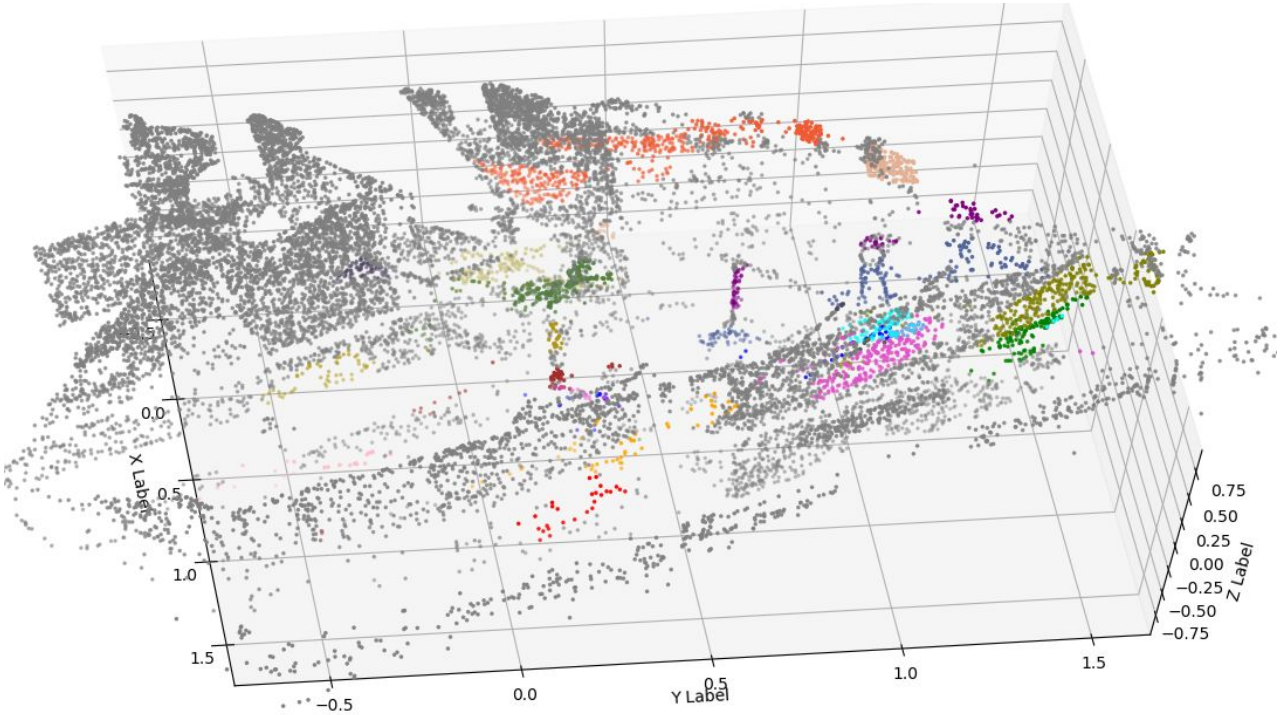






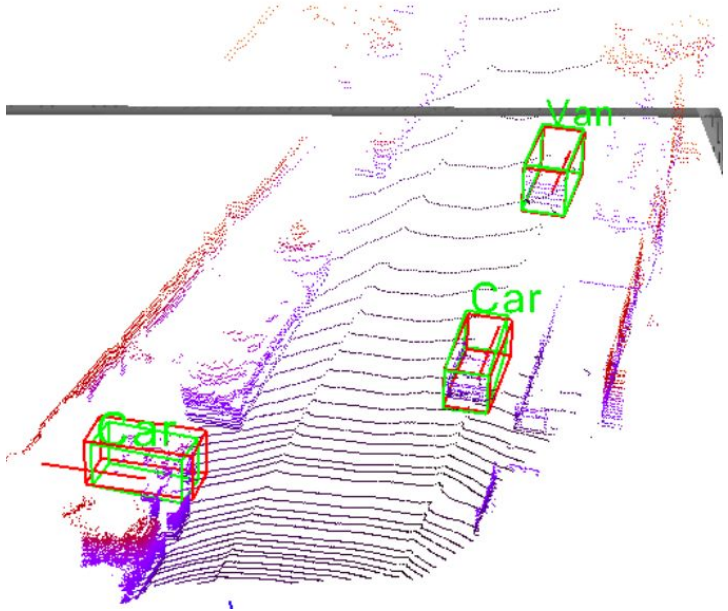
Scenes from Plan_ouates.

Results 6 (bbox viz)



Conclusion

- Improve Classification head performance
- The data is more complicated than the KITTI dataset
- Need more data



Questions