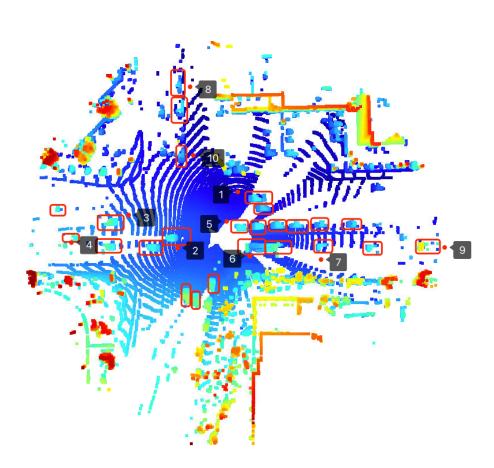
3D Object Detection

1. Find and display 10 examples of vehicles with varying degrees of visibility in the point-cloud.

In the following image, all objects highlighted with red boxes are vehicles. 10 representative vehicles have been marked from 1 to 10. It can be observed that the closer the vehicle to the lidar car, the more complete point cloud it is, making it easier to recognize the shape of the vehicle.

Open3D



2. Identify vehicle features that appear as a stable feature on most vehicles (e.g. rearbumper, tail-lights) and describe them briefly. Also, use the range image viewer from the last example to underpin your findings using the lidar intensity channel.

The stable features are: 1) The shape and size are generally similar to that of a car. 2) The intensity values are higher near the car's front, particularly around the windows and

headlights(In Figure 1). 3) The height values gradually increase from the edges to the center(In Figure 2).

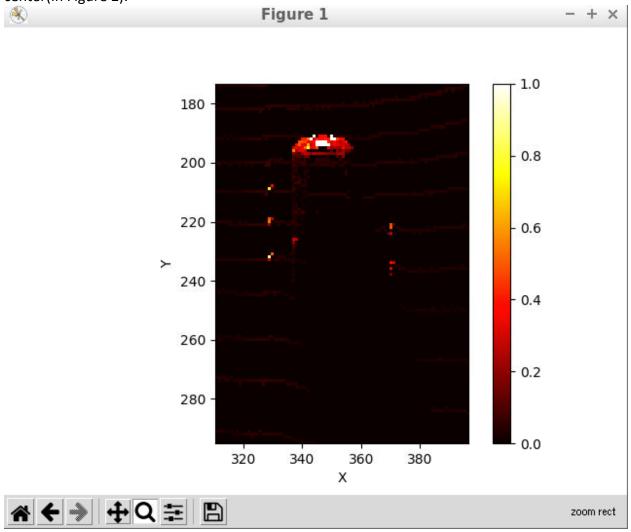


Figure 1. Intensity map of vehicle

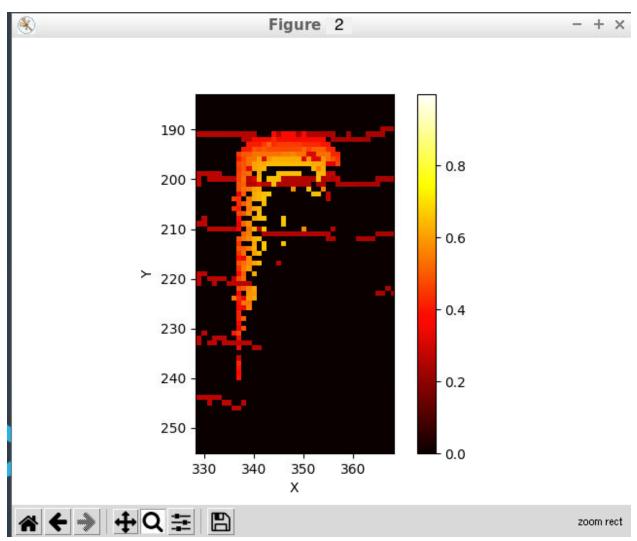


Figure 2. Height map of vehicle

3. Other visualizations during the mid-term projects.

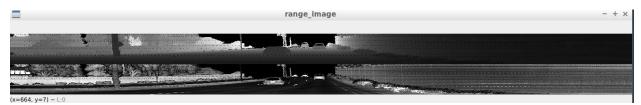


Figure 3. Crop range image to +/- 90 deg. left and right of the forward-facing x-axis

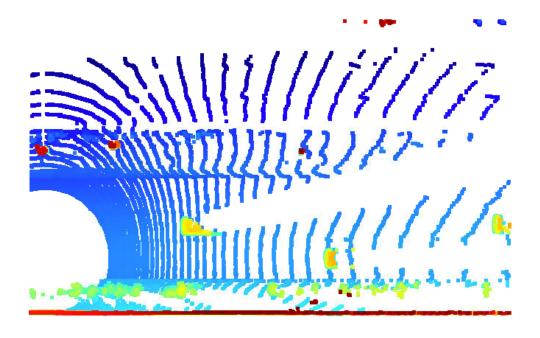


Figure 4. BEV map

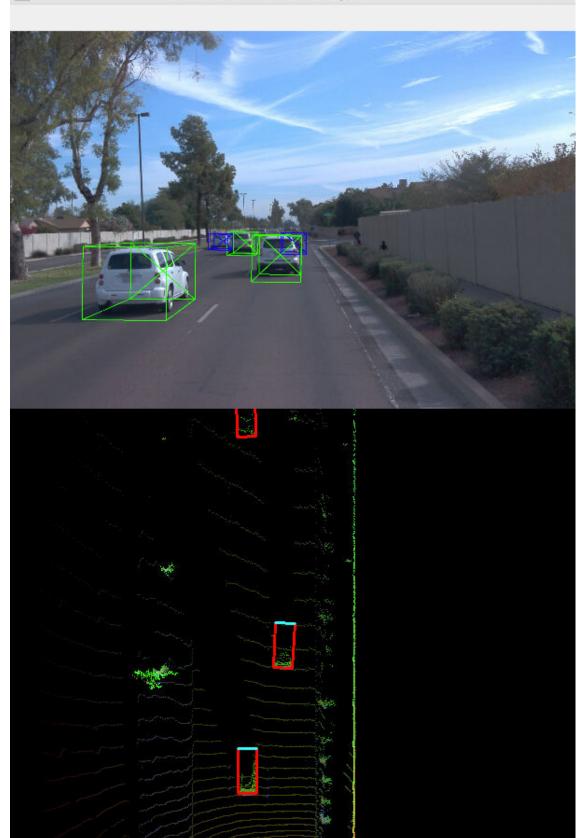


Figure 5. fpn-resnet detection result ☑ root@60ace2ac016861bd065ae6...97bb-86zvw: /home/workspace

☑ root@60ace2ac016861bd065ae6f4f1f5ecbf291a20c2-5fb9f797bb-86zvw: /home/work 50ace2ac016861bd065ae6f4f1f5ecbf291a20c2-5fb9f797bb-86zvw: /home/workspace 80 eners [(33.574110886224785, 2.38691756796215), (33.455145594283685, -1.7 b681196), (35.4193465254475, -1.8237822414153557), (35.532899144485846, 4682348079)]
ist [0.03930282 0.03091868 0.90299099]
331207452 -1.7668831609681196 35.532899144485846 2.271794682348979 54202992 9.054955569742669
59772434303954
eners [(26.673114934559738, 9.638235598454408), (26.432330671168312, 4.9376454), (28.687862810277, 9.5357031)] detection recall detection precision intersection over unior 703)] st [6.97322844 -6.95291272 0.90299099] 31207452 4.937538350776454 28.687862810277 2.429621878826847 1199836505 0.8 0.8 task ID_S4_EX2
formance [[0.8750428310389062, 0.9374460959122509, 0.9069772434303964],
80809480564494, 0.09775575929779734, 0.54138127472378981, [0.00319752215,
0.08876197743126429, 0.8106015079038116], [0.03930281529392232, 0.0305
8094398, 0.902909934126863]], [3, 3, 0, 0]]
end of selected frames
task ID_S4_EX3
1, FP = 14, FN = 15
on = 0.9540983606557377, recall = 0.9509803921568627 20 0.6 0.6 15 0.4 0.4 10 0.2 0.2 0.0 0.0 0.5 1.0 0.5 1.5 0.8 0.9 1.0 position errors in X position errors in Y position error in Z mean = 0.0431 sigma = 0.0461 35 mean = 0.0184 mean = 0.8356 50 25 sigma = 0.1408 sigma = 0.1664 30 n = 291 eb Browser n = 291 n = 29140 20 25 20 30 15 15 20 10 10 10 5 0 1 -0.25 0.00 0.25 0.0 0.1 0.5 1.0 **☆** ← → **+** Q = B

Figure 6. Precision and Recall of darknet