

Occupancy Grid Updates for Autonomous Driving

Course 4, Module 2, Lesson 3

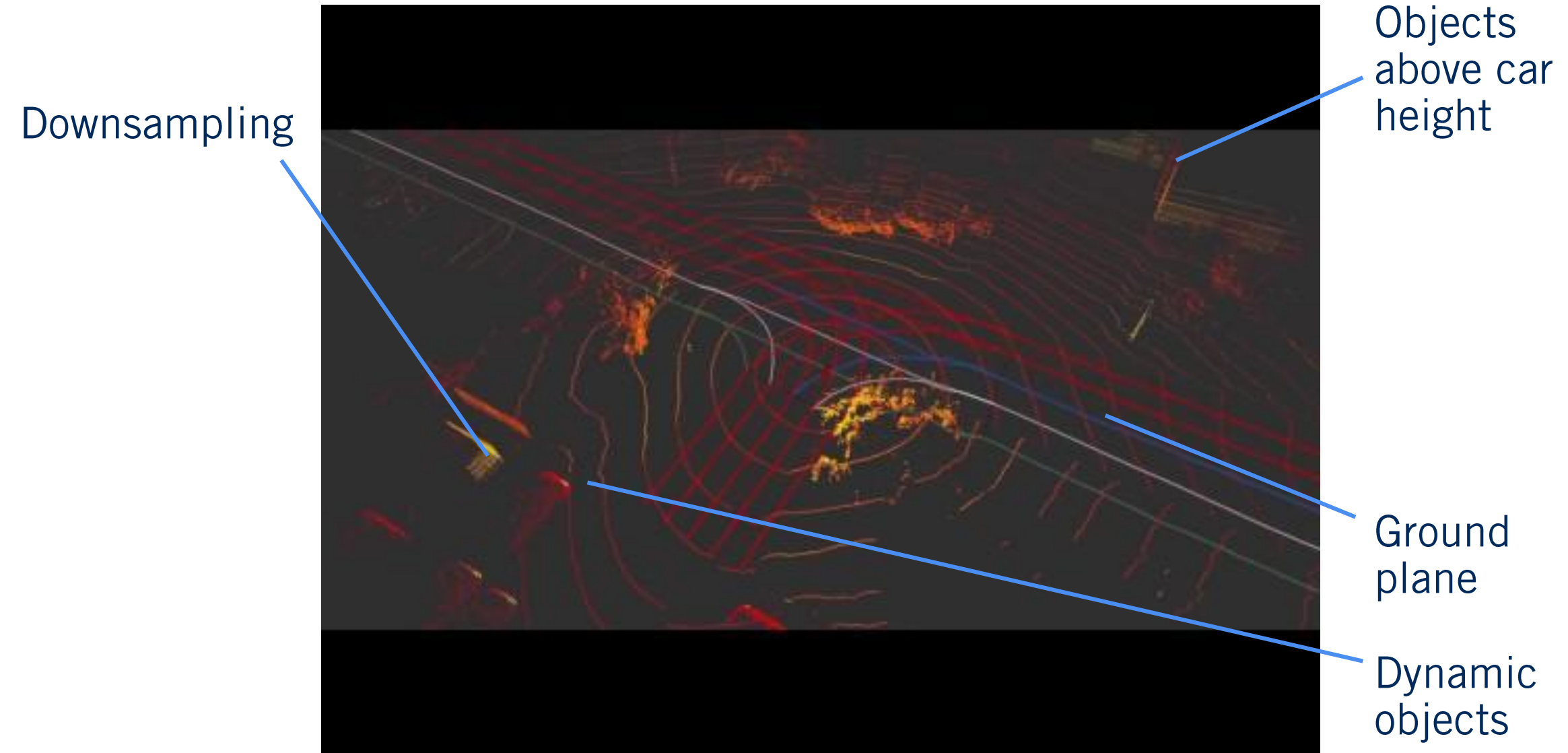


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Learning Objectives

- Requirement for converting 3D lidar data to 2D data suitable to be used by occupancy grid
 - Set of filters required for 3D lidar data
 - 3D to 2D projection
 - Tuning the occupancy grid for the task of autonomous driving

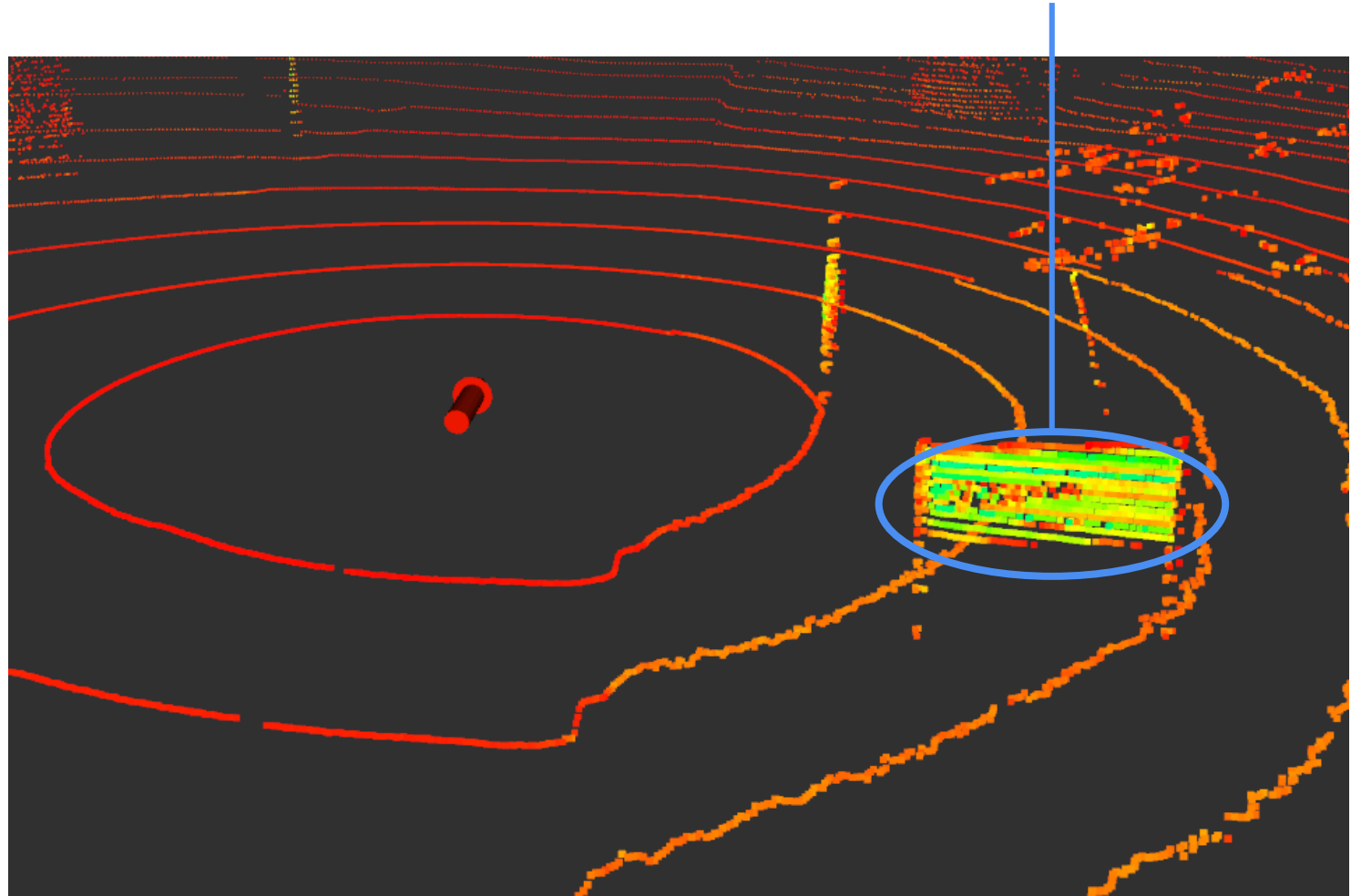
Filtering of 3D LIDAR



Downsampling

- Up to ~1.2 million points per second
- Removal of redundant points
- Improves computation

Redundant points



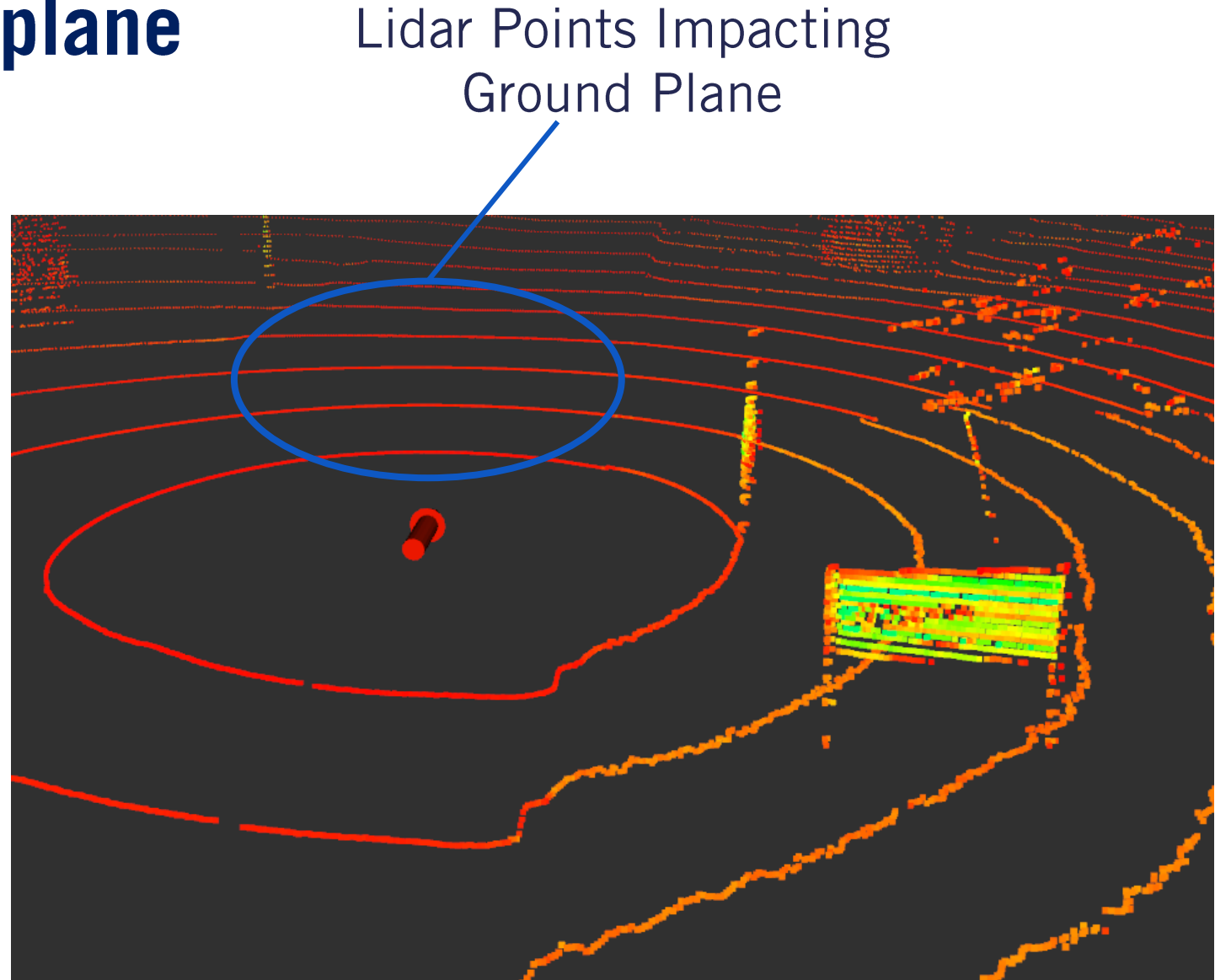
Removal of overhanging objects

- Removing all Lidar points that are above a given threshold of the height limit of the car



Removal of ground plane

- Difficult to estimate due to several complications
 - Differing road geometries
 - Curbs, lane boundaries
 - Don't want to miss small objects



Ground plane Classification

- Utilize segmentation to remove points of road elements
- Keep points from no drivable surfaces



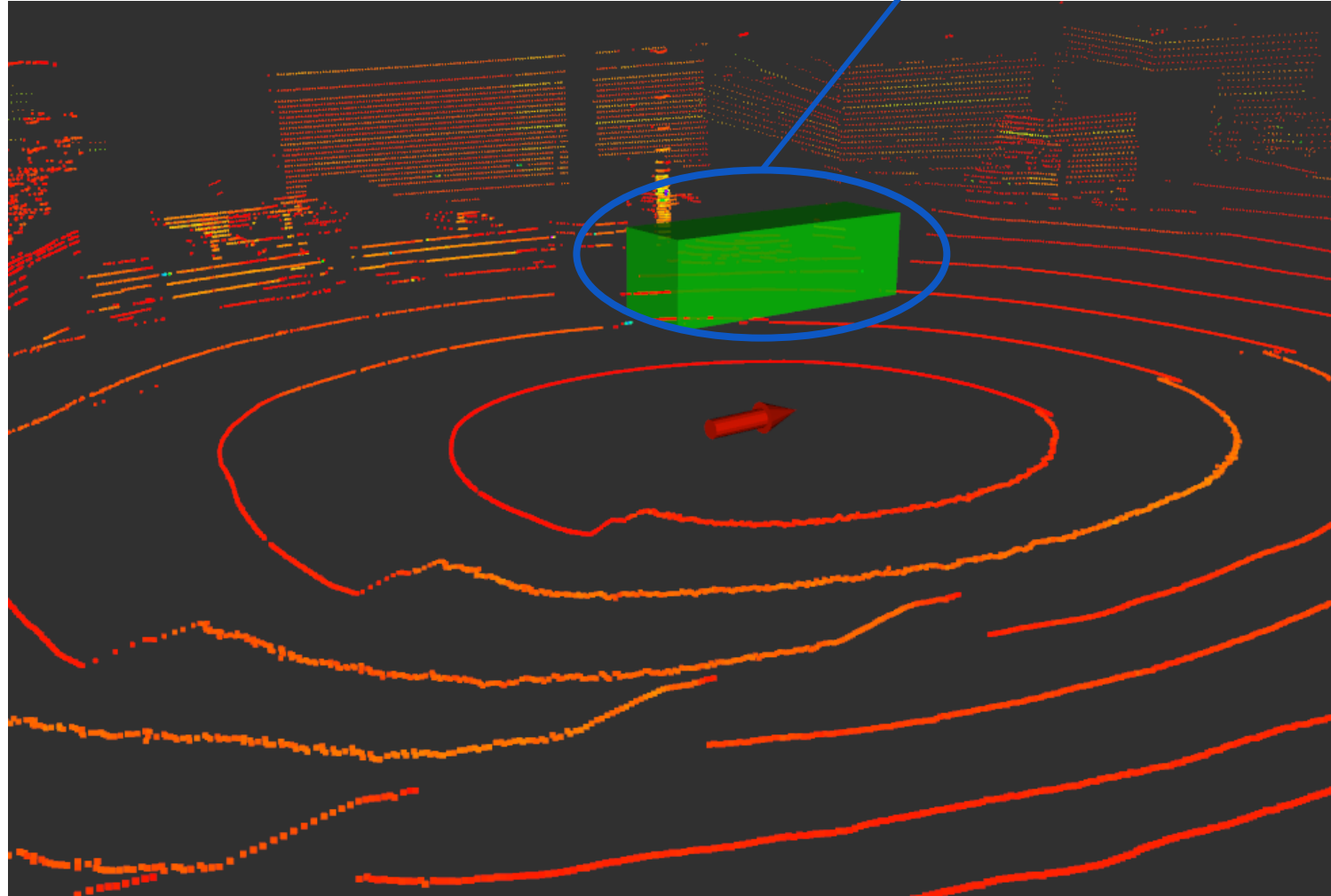
Removal of Dynamic Objects

Dynamic Object (Car)



Removal of Dynamic Objects

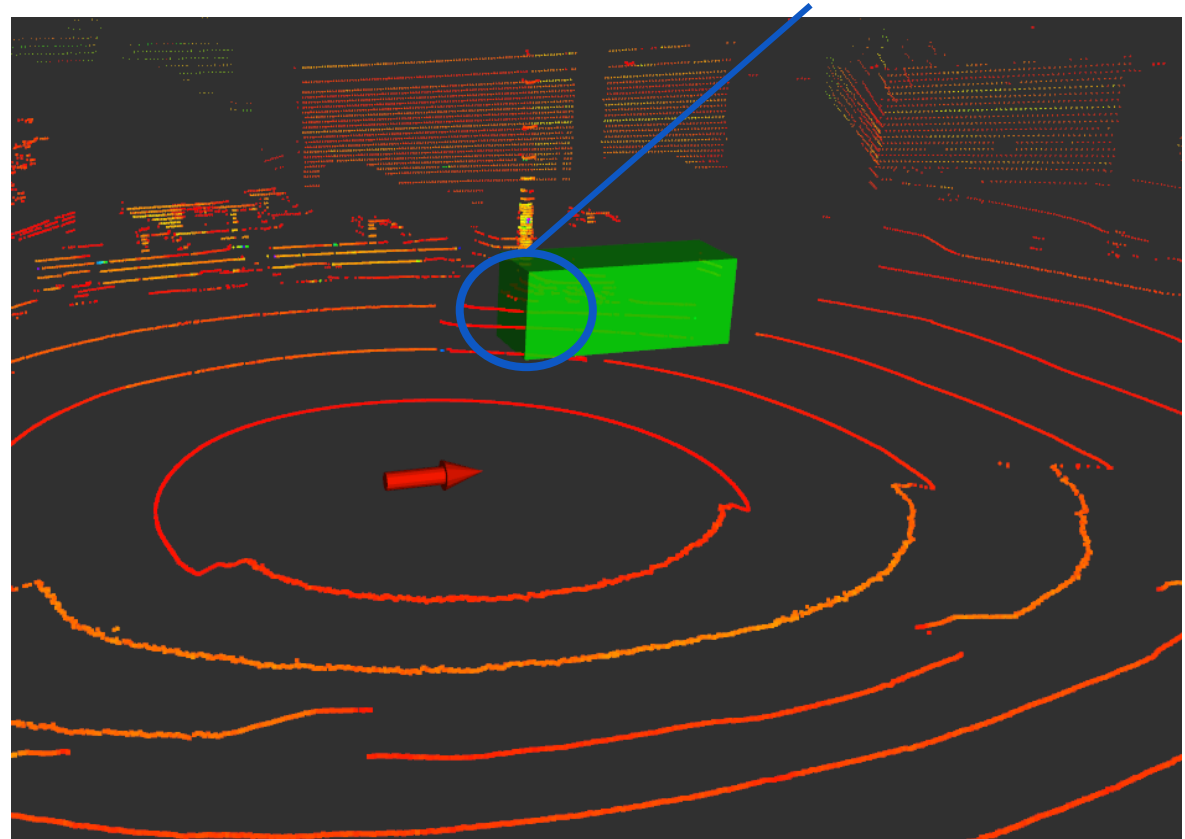
Remove 3D bounding
+ threshold



Removal of Dynamic Objects Improvement

- Not all vehicles are dynamic, so they should be included
- History of dynamic object location can be used to identify parked vehicle
- The dynamic objects are identified from the previous LIDAR frame
- Predicted future location improvement

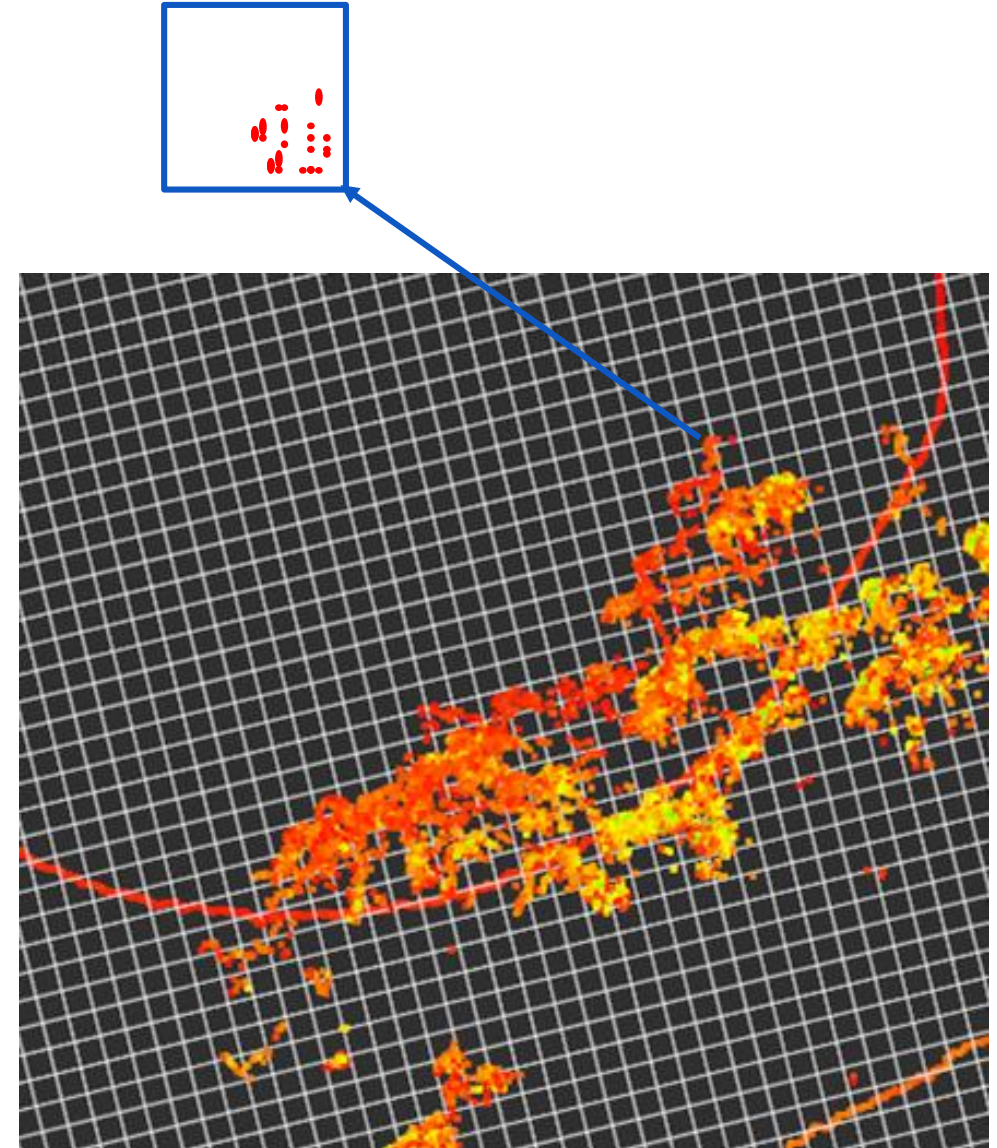
LIDAR points of the car



Projection of LIDAR Onto a 2D Plane

Simple solution:

- Collapse all points by Zeroing the Z coordinate
- Sum up the number of LIDAR points in each grid location
 - More points indicated greater chance of occupation of that grid cell



Summary

- Set of filters required for 3D lidar data
 - Downsampling
 - Transforming 3D lidar data into a 2D belief map
 - Tuning a occupancy grid for autonomous driving
 - Removing lidar above the vehicle
- Ground plane removal
- Removal of dynamic object