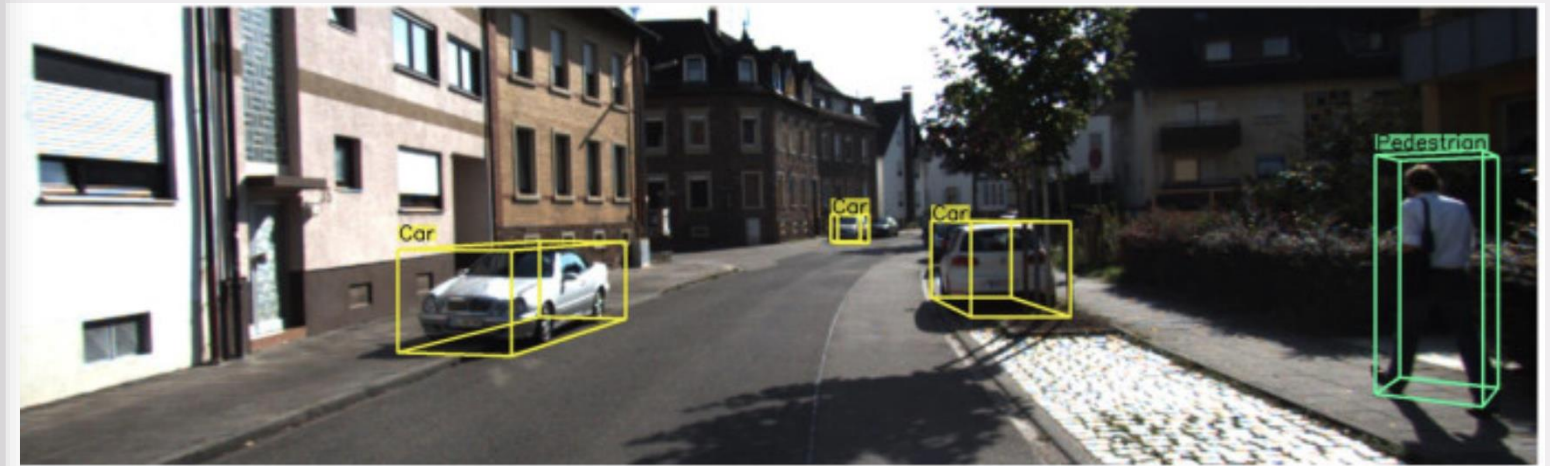


# 3D Object Detection For Self-Driving Cars



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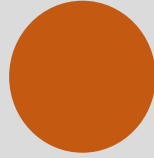
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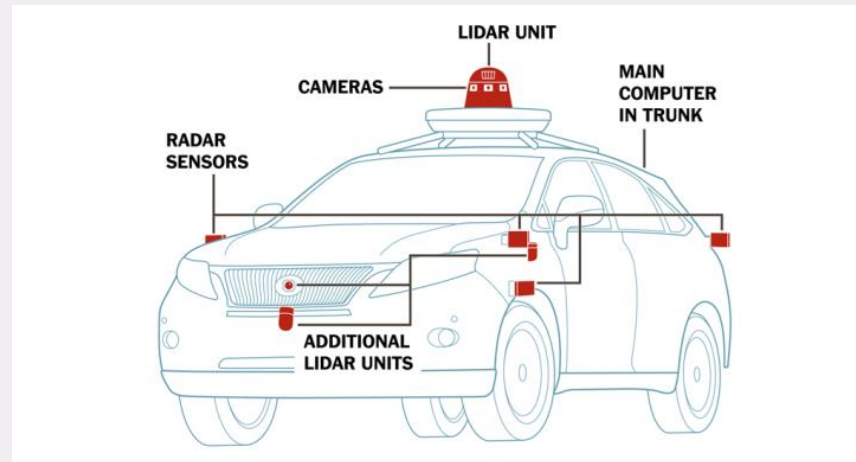
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## Perception

Object detection is one of perception task which is classify and identify the objects around the autonomous vehicle. Currently, there are 4 main exteroceptive sensor technologies, those are; Camera, LiDAR, RADAR and SONAR. Among these sensors, Cameras and LiDAR's are more important primarily rather than RADAR and SONAR. Since, RADAR sensors are providing longer observing range in large objects, and SONAR sensors measure short-range objects by using sound-waves.



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We have researched academic papers related to our research project topic. These are; Real-time object detection, Sparse Voxel-Graph for 3D Object Detection from Point Clouds and Multi-column Deep Neural Networks for Image Classification.



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	Pros	Cons
2D	<ul style="list-style-type: none"><li>-Convolutional Neural Networks are perform well over 3D data.</li><li>-Less computation power rather than 3D data.</li><li>-Less cost to equip the ego vehicle.</li><li>- Able to collect RGB information.</li></ul>	<ul style="list-style-type: none"><li>- It can effect heavy sunlight improperly.</li><li>- Depth information is not available.</li></ul>
3D	<ul style="list-style-type: none"><li>-LiDAR sensors are capable to scan the 3D map(360-degree) of the environment of the ego vehicle.</li><li>-It is able to give rapid response ( &lt; 100ms&amp;360-degree scan).</li><li>- Usually better performance than 2D</li><li>- It works well both in daylight and nightlight.</li></ul>	<ul style="list-style-type: none"><li>-It is unreliable in heavy rains .</li><li>- LiDAR collects massive and complex data which require comprehensive data analyze skill.</li></ul>



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- Data collected by 10 host cars
- Images are captured with 7 cameras
- LIDAR data captured by 3 sensors. One sensor at the top of the car and two sensors at the front, under the lights.



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117 GB DATA

192.276

**Camera Data**  
For Test Set



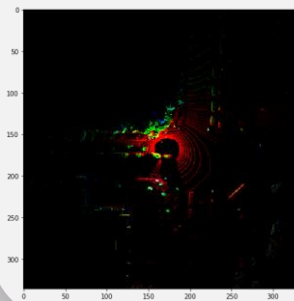
158.757

**Camera Data**  
For Training Set



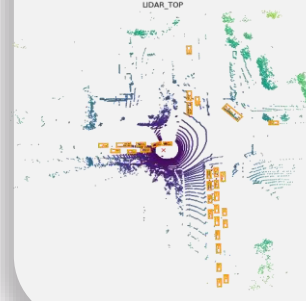
30.744

**LIDAR Data**  
For Test Set



27.468

**LIDAR Data**  
For Training Set



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To make realize self-driving cars into roads, and make them alternative to human based driving, there are some certain issues to be solved.

In 2018, Uber's self-driving car crash led to a pedestrian fatality. There was significant confusion in the software detection system.



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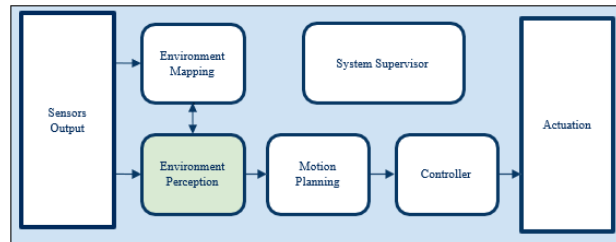
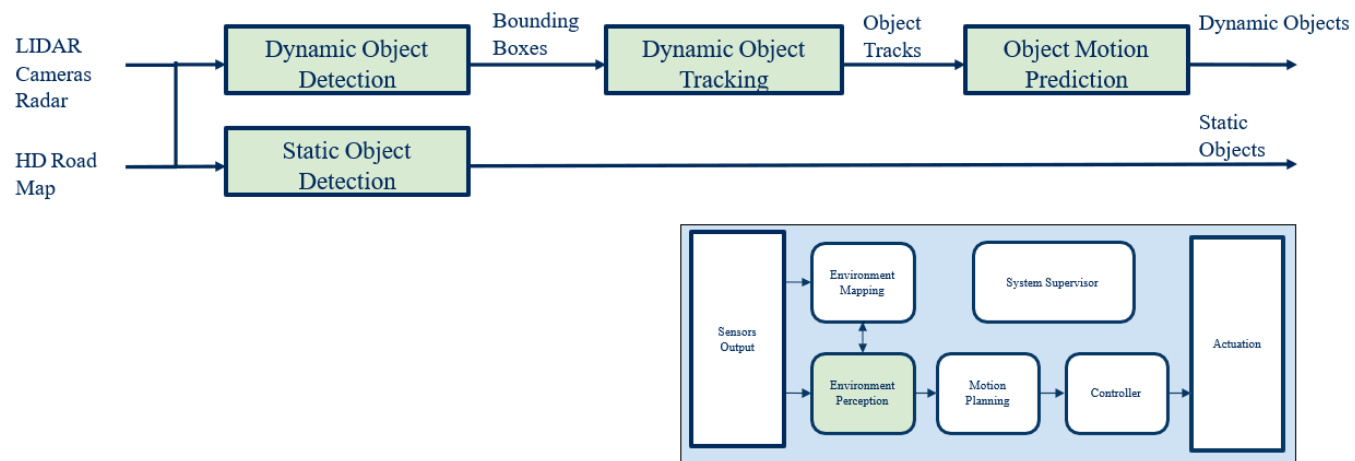
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## Environment Perception

### Inputs



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We are planning to approach to the 3D dataset with VoxelNet which is provide both bound boxing and feature extraction from point clouds.

For 2D dataset, Fast R-CNN, Faster R-CNN and R-CNN will be applied.

### Technologies Used



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At the end of this project, we will optimize the object detection algorithm for self-driving cars by working with 117 GB of data, and we will enable it to accurately detect objects such as pedestrians, cyclists, obstacles, moving cars and parked cars in a short time.



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- [1] <https://www.kaggle.com/c/3d-object-detection-for-autonomous-vehicles>
- [2] Deep SCNN-based Real-time Object Detection for Self-driving Vehicles Using LiDAR Temporal Data
- [3] Multi-column Deep Neural Networks for Image Classification
- [4] SVGA-Net: Sparse Voxel-Graph Attention Network for 3D Object Detection from Point Clouds
- [5] <https://pythonawesome.com/stereo-r-cnn-based-3d-object-detection-for-autonomous-driving/>



# **Thank You For Listening**

## **Any Questions?**