Design and Verification of Algorithms for Object Detection and Tracking Using Lidar Data
Design and Verification of Algorithms for Object Detection and Tracking Using Lidar Data: who can I contact?

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Design tracker for lidar point cloud data
Agenda

- Object Detection

- Object Tracking
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Lidar data visualization

Visualization of one frame of the LiDAR point cloud
Segmenting the Ego Vehicle

Reflection points generated by the ego vehicle

Knowing the vehicle dimensions and sensor position makes this segmentation possible
Segmenting ground plane

Different colors used for road reflections, the ego vehicle, and still-unlabeled points.
Segmenting nearby obstacles

Segment nearby obstacles by looking for all points that are not part of the ground or ego vehicle within regions of interest around the ego vehicle.

Information needed for tracking algorithms:
• 3D bounding boxes
• time of detection
• uncertainty of the measurement
% Find the ground points.
groundPtsIdx = segmentGroundFromLidarData(ptCloud);

% Map color ground points to green.
colorLabels(groundPtsIdx (:)) = greenIdx;

% Map color nonground points to red.
colorLabels(~groundPtsIdx (:)) = redIdx;
Fit cuboid to lidar point clouds

<table>
<thead>
<tr>
<th>Function name</th>
<th>Purpose</th>
<th>Applications</th>
</tr>
</thead>
</table>
| pcfitcuboid   | Fits a cuboid to an entire lidar point cloud or to a selected set of points in it. | ▪ Vehicle detection  
▪ Tracking |

% fitting bounding boxes around segmented object
Model = pcfitcuboid(pc, label_id)

Documentation
Lidar Object Detection and Tracking
Segmenting Point Clouds with Neural Networks

Examples: Lidar Object Detection and Tracking
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Challenges for tracking of objects in LiDAR point clouds

- Self occlusion
- Maneuver estimation
- Tracking reliability
Compensate self occlusion effect
Detection and tracking algorithm in use
Compute probability of Constant Velocity (CV) and Constant Turn Rate (CT) mobility models
Have a look to real example results

Example Link
Verify algorithms results
Agenda

- Object Detection

- Object Tracking
What is Lidar Toolbox

- **Library of algorithms** for Lidar processing
  - Including registration, detection, and segmentation
- **Reference Applications** for autonomous systems
- Calibration and labeling **Apps**
- High performance **visualization**
- **Code generation** and deployment support
- **Readers and streamers** support
- Lidar Toolbox depends on **Computer Vision Toolbox**

Lidar Toolbox is the starting point for lidar and point cloud processing
Lidar Toolbox Capabilities

- Deep learning for lidar
  - Object Detection and Semantic Segmentation
  - Lidar Labeling App

- Calibration
  - Lidar Camera Calibration
  - Collision Warning System

- 2D Lidar Processing

- Live Streaming
  - Velodyne Support Package
  - Map Building Workflow

- Map building and SLAM

- Lidar I/O
  - Reading and Writing
  - Object tracking
    - Cuboid Fitting and Tracking
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