Obstacle Classification using 3D point cloud and Image data in self driving car application

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INTRODUCTION

The coming age of Artificial Intelligence has set new standards for our future. One of the major applications of AI in this vision of future is self-driving cars. Cars that are able to navigate, avoid obstacles and are able to adapt to changes in their environment. Obstacle detection and recognition are going to be vital to the realization of our dream of self-driving cars. We aim at detecting Cars here.
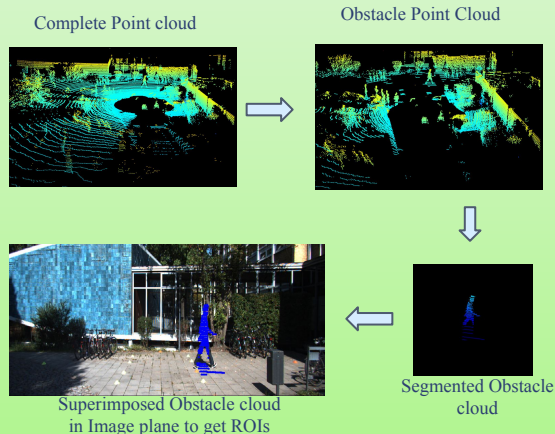
PROBLEM FORMULATION

A Velodyne HDL-64E Laserscanner data and Point Grey Flea 2 (FL2-14S3C-C) Color Camera data are fitted on a car driving in an urban setting. For each image a corresponding 3D point is available. Detection and Identification of car in Image frame using Image processing and point cloud handling.

[image]The setup[2]
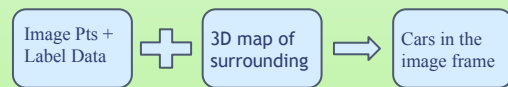
METHODOLOGY

I.   Trained Cascade Classifier[3] : Set of images(~5000)
   A.   Used HOG features[1]
   B.   Cascade stages ~15
   C.   Trained multiple classifiers for different orientations of the cars
II. Segmentation of interest regions from point cloud[4]
   A.   Used Modified Velodyne Height Map
   B.   Near Neighbour technique based individual object cloud segmentation
   C.   Finding corresponding image points
III. Detection of car on Test images
   A.   Finding bounding boxes using classifier[5]
   B.   Filtering using possible candidates from each object point cloud

Complete Point cloud

Obstacle Point Cloud

Segmented Obstacle cloud

Superimposed Obstacle cloud in Image plane to get ROIs

RESULTS

With a cascade classifier based on image data, false positives were unavoidable. Any collection of features resembling a car could be easily be confused with a car. But point cloud data works works on an entirely new domain. It gives us the information of depth. These features would be very different for images that were confused as cars. Hence, as expected use of point cloud data brought down the number of false positives significantly.

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