On-Road Vehicle and Lane Detection

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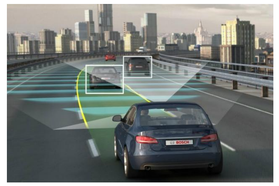
Motivation

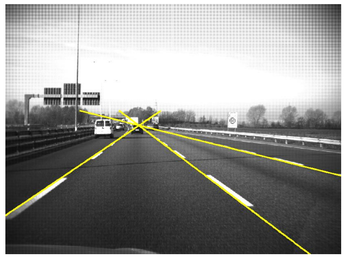
- Facilitate self-driving car



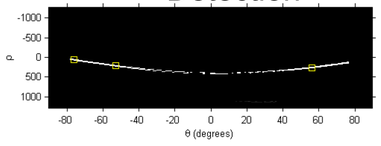
Objective

- Detect lanes/vehicles; estimate distance from monocular vision

Lane Detection

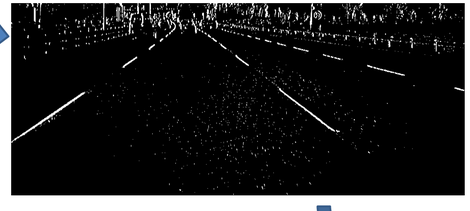


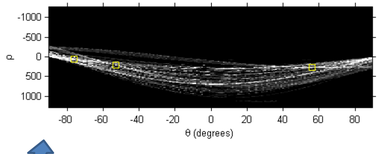
4. Lane Detection



1. Edge Detection

3. Vanishing Point Filter



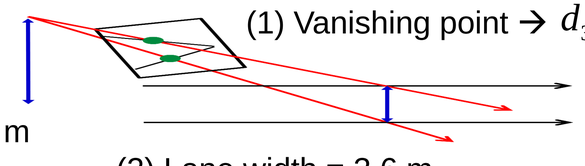


2. Hough Transform

3D Ground Plane Reconstruction

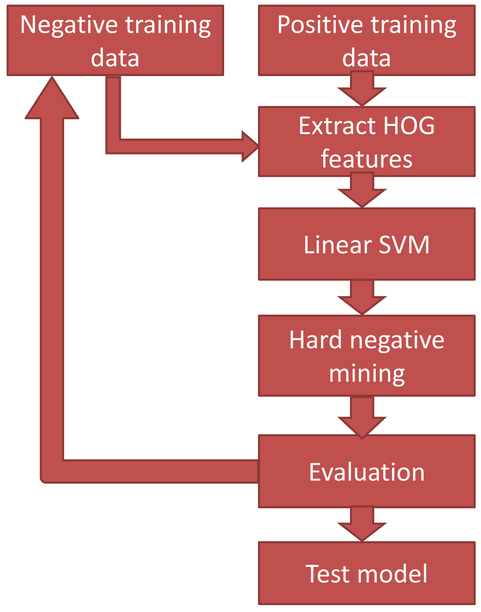
(0) Camera matrix known

(1) Vanishing point → $\overrightarrow{d_{3D}}$



(3) Camera height = 1.6 m

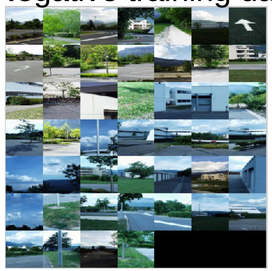
(2) Lane width = 3.6 m



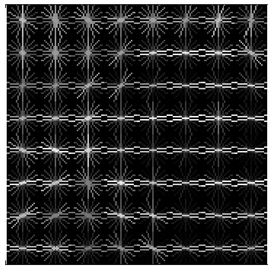
Car Detection

Positive training data

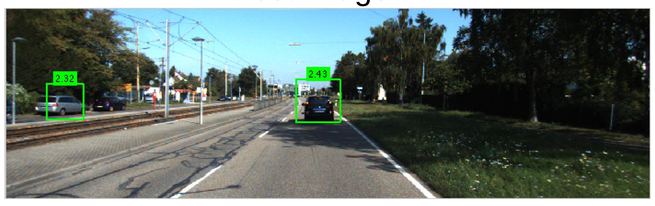
Negative training data



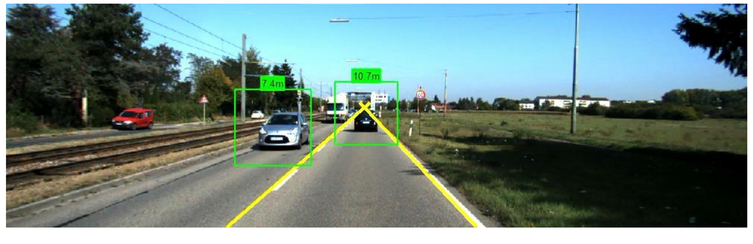
HOG model

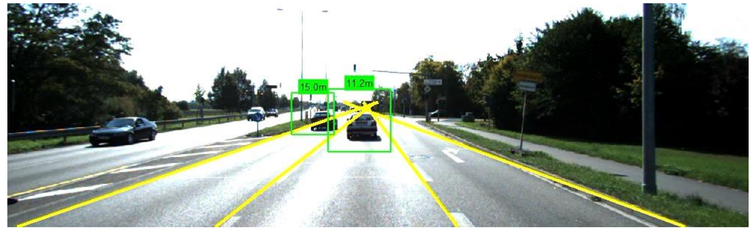


Test image



Results and Demo





Difficulty & Future Plans

- Curved lanes are not considered.
- Car detection precision/recall not good enough; bounding box not tight enough
  → RBF Kernel SVM + Optimization
  → Refine positive training data: tight bounding box
- Occlusion is not resolved
  → object tracking
- Program is too slow → reduce search

Reference

[1] A. Geiger, "Vision meets Robotics: The KITTI Dataset," IJPR, 2013. [2] A. Vedaldi and A. Zisserman, “Object category detection practical” [3] Matlab Lane Departure Warning System [4] C. Caraffi, "A System for Real-time Detection and Tracking of Vehicles from a Single Car-mounted Camera," ITCS, 2012