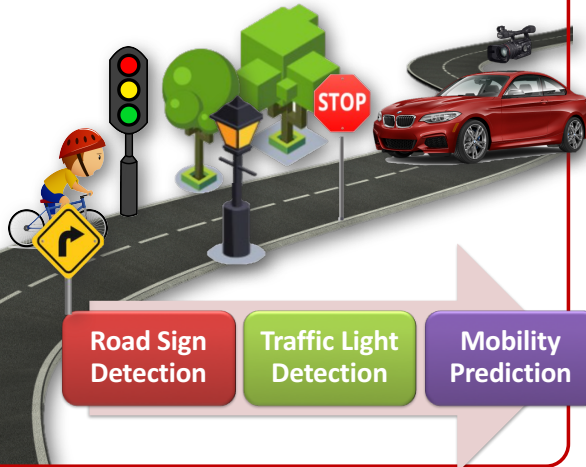


# Video Processing on Vehicle Front View Camera

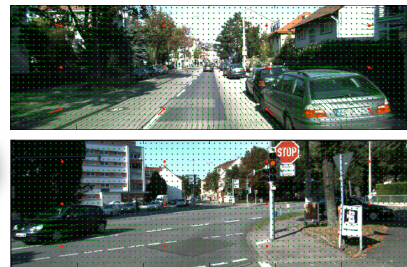
Yaqi Zhang

Department of Electrical Engineering, Stanford University

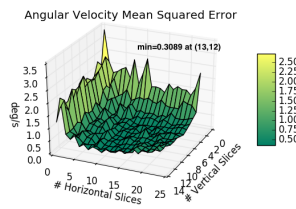
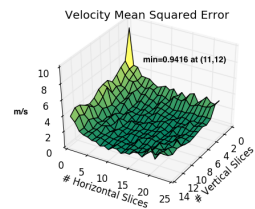
How should our car understand what it observed?



## Mobility Prediction

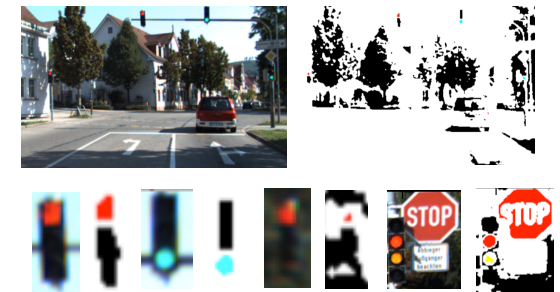


Model	Linear Model
Input	Magnitude and angle of averaged optical flow
Output	Forward velocity Forward angle velocity
Training data	80% frames from 3 KITTI[1] benchmarks
Testing data	20% frames from 3 KITTI[1] benchmarks
Best MSE	1.09km/h, 0.53 deg/s



## Traffic Light Detection

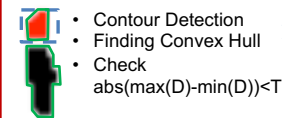
Color Mask



- Blur Image
- Find color mask

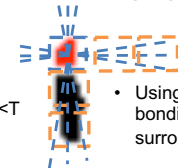
$$\begin{aligned}
 setR &= (X_R - X_G) \geq T_R \ \& \ (X_R - X_B) \geq T_R \quad [2] \\
 setY &= (X_G - X_B) \geq T_Y \ \& \ (X_R - X_B) \geq T_Y \\
 setG &= (X_G - X_R) \geq T_G \ \& \ (X_B - X_R) \geq T_G \\
 setK &= (X_R \leq T_K) \ \& \ (X_G \leq T_K) \ \& \ (X_B \leq T_K)
 \end{aligned}$$

Geometry Filtering



- Contour Detection
- Finding Convex Hull
- Check  $abs(max(D)-min(D)) < T$

Surrounding Light Detection



- Using mask in bonding box to match surrounding color

## Road Sign Detection



- Sign Blurring
- SIFT Keypoint Descriptor
- KNN matching
- Ratio Test
- Homography (RANSAC)



- Matching result strongly effected by illumination
- Using sliding window + histogram equalization



- Road sign with very simple shape
- Unable to match because too few keypoints and symmetric sign fails ratio test after KNN matching

## Related Work

- [1] Geiger, Andreas, et al. "Vision meets robotics: The KITTI dataset." *The International Journal of Robotics Research* (2013): 0278364913491297.
- [2] Yu, Chunhe, and Ying Bai. "A Traffic Light Detection Method." *Advanced Technology in Teaching*. Springer Berlin Heidelberg, 2012. 745-751.
- [3] Lucas, Bruce D., and Takeo Kanade. "An iterative image registration technique with an application to stereo vision." *IJCAI*. Vol. 81. No. 1. 1981.