

Automated Traffic Sign Detection for Modern Driver Assistance Systems

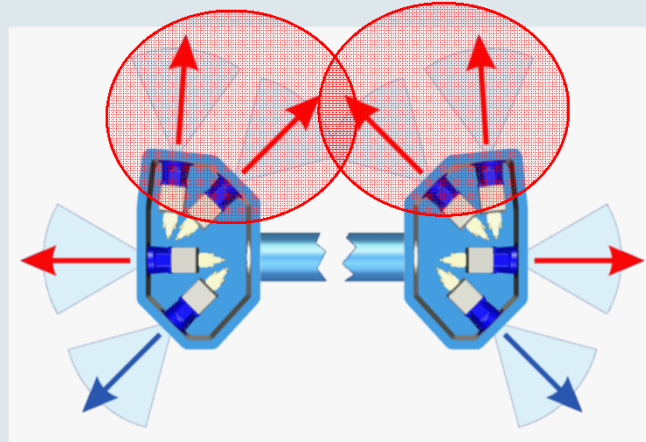
Alexander Reiterer¹, Taher Hassan², Naser El-Sheimy²

¹ Institut of Geodesy and Geophysics
Vienna University of Technology

² Department of Geomatics Engineering
University of Calgary



Motivation / System



Two camera enclosures are attached on each side of the roofmount. Each camera enclosure is the exact mirror of the other.

Motivation

Detecting traffic signs in images (1600 x 1200) which have been captured by

Solution:

- Build a data-base (models) by features.
- Compare features of the data-base with new images/features.

Precondition:

- Fast execution (real time)
- Easy to use and easy to include new data sets

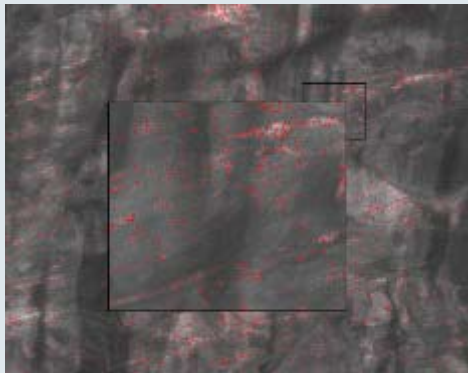


Procedure

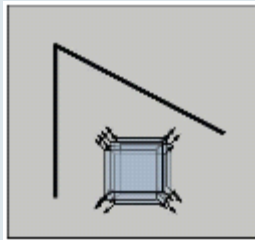


Procedure

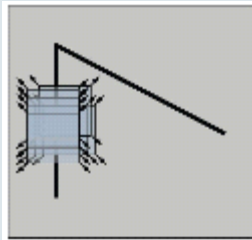
(1) Detection of "Interest Points"



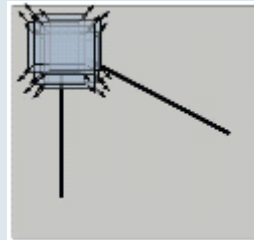
Procedure



“Flat Region”



„Edge“

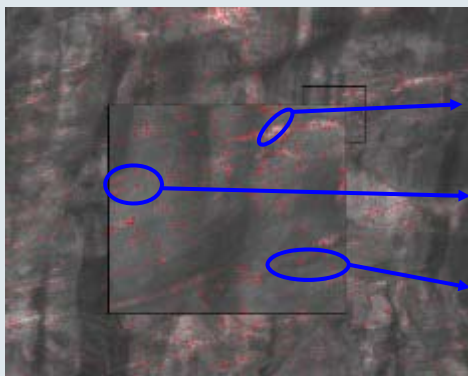


„Corner“

Procedure

(1) Detection of “Interest Points”

(2) Calculation of “Point Descriptors”



[0 12 31 0 0 23 ...]

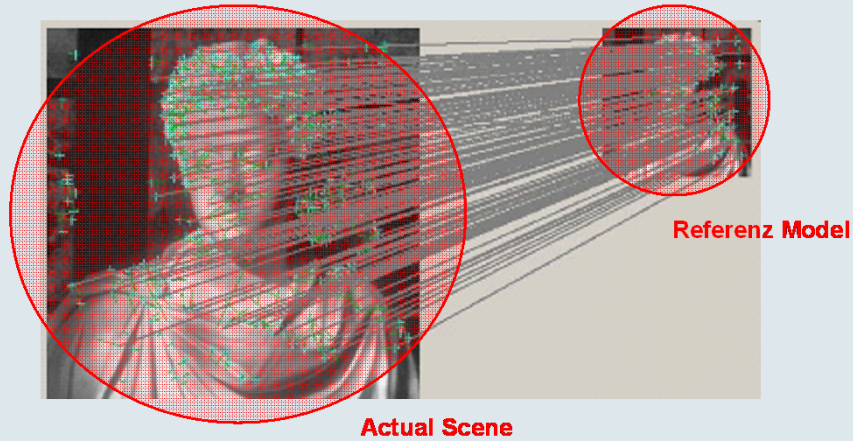
[5 0 0 11 37 15 ...]

[14 21 10 0 3 22 ...]

“Interest Point” are described by
128 numerical Values.

Procedure

(3) Matching/Comparing of "Point Descriptors"



Procedure

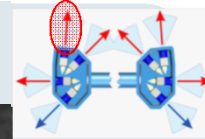
Models/Database



Images

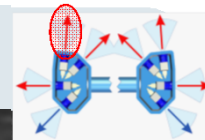


Example



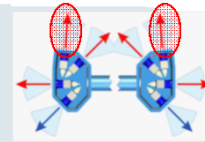
Points characterized
as points inside a traffic sign

Example



Calculated axis of the
traffic sign

Example



Cam 1

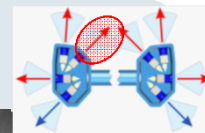


Cam 5



→ 698510.59 5668645.94 1233.79

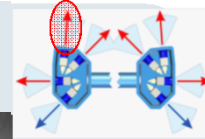
Example



Cam 7



Example



Traffic sign 1 (cluster 1)



Traffic sign 2 (cluster 2)

First Results

Tested: 53 images (all 4 cameras)

Only Speed Limit Traffic Signs (5 models):

Images	Traffic Signs	Detected TS	False Detected TS	Not Detected TS
53	63	57	0	6
--	--	90,5%	0%	9,5%

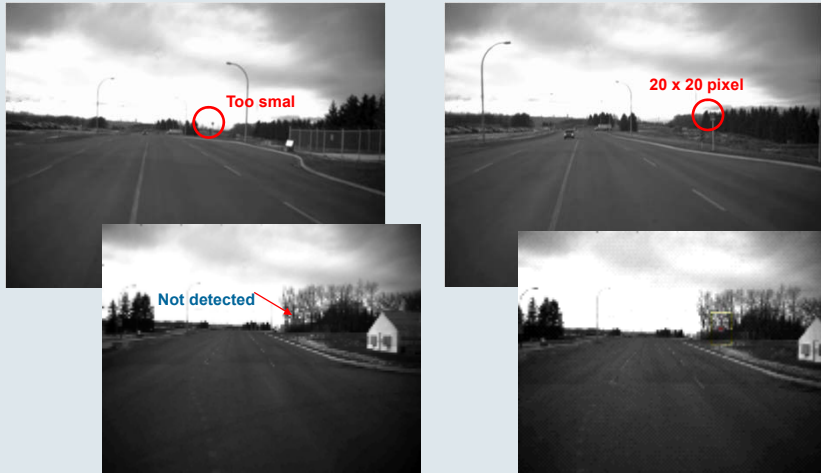
All signs in the images (7 models):

Images	Traffic Signs	Detected TS	False Detected TS	Not Detected TS
53	72	57	0	15
--	--	80%	0%	20%

Important: All traffic signs have been detected in at least one image pair! (regarding cam 1 and cam 5)

Evaluation - Predefinition

What is a traffic sign? → Minimal size of 20 x 20 pixel!



Evaluation

Examples of an image of the dataset



- Images: 400
- Traffic Signs: 120
- Detected Traffic Signs
- Detected Traffic Signs (cam 1 / left)
- Detected Traffic Signs (cam 5 / right)

~78% (93)
~81%
~73%

Evaluation

Main Problem:

Big, but too dark traffic signs!



No relevant texture! (cam 1)



Closest captured image!



Conclusion

- Automated traffic sign detection method which has been tested on image sequences captured by a mobile mapping system (*VISATTM*).
- The presented technique is based on existing algorithms, like the SIFT operator and the k-means clustering.
- Whole sequence has been implemented under MATLAB into a running prototype
- The system shows a sufficient detection rate of about 78%. Under ideal lighting conditions (e.g. constant illumination) detection rates of over 85-90% have been achieved.



Alexander Reiterer
Automated Traffic Sign Detection for Modern Driver Assistance Systems

Thank you for your attention!

Contact:

Alexander Reiterer
Research Group Engineering Geodesy
Institut of Geodesy and Geophysics
Vienna University of Technology

alexander.reiterer@tuwien.ac.at