Real time vehicle detection and tracking on multiple lanes

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INTRODUCTION

- Video sensors or cameras combined with image processing algorithms are becoming a common approach to today's road traffic monitoring and control
- Video sensors allow robust and continuous measurement of road traffic parameters
- High level traffic information can be extracted, i.e. incident detection, vehicle classification, origin-destination (OD) matrix estimation, etc.

MOTIVATION

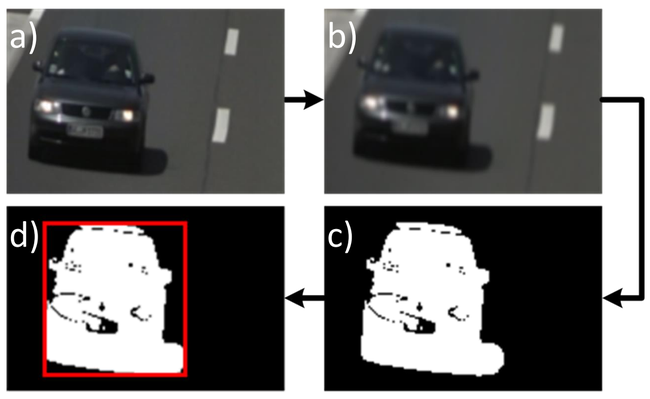
- Typical commercial computer vision based traffic monitoring systems use one camera per lane to ensure accurate and robust traffic parameters measurement – drawback since many cameras are needed for roads with multiple lanes which makes such systems expensive
- Proposed system tackles the mentioned problem by modified image processing part to enable vehicle detection and tracking on multiple lanes in real time

IMAGE PROCESSING

VEHICLE DETECTION

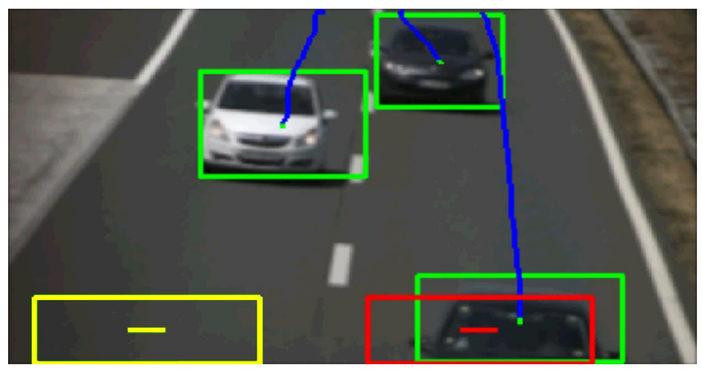
Basic work flow of vehicle detection consists of:

- Original image (a) downsampling and bluring (b)
- Creation of background image model and comparison of background image model and current image (c)
- Pixel clusterization (d)



VEHICLE TRACKING AND COUNTING

- In the proposed system, spatio-temporal tracking of objects in a scene is used for filtering
- Every currently tracked object in the scene is compared with each cluster detected in the current image
- When a vehicle passes through marker and a hit is detected, counter for that marker is incremented

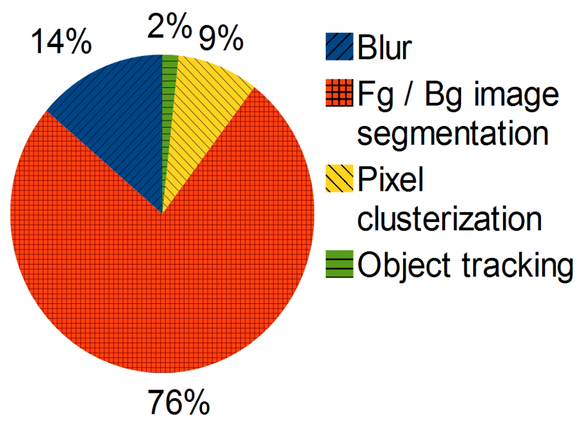


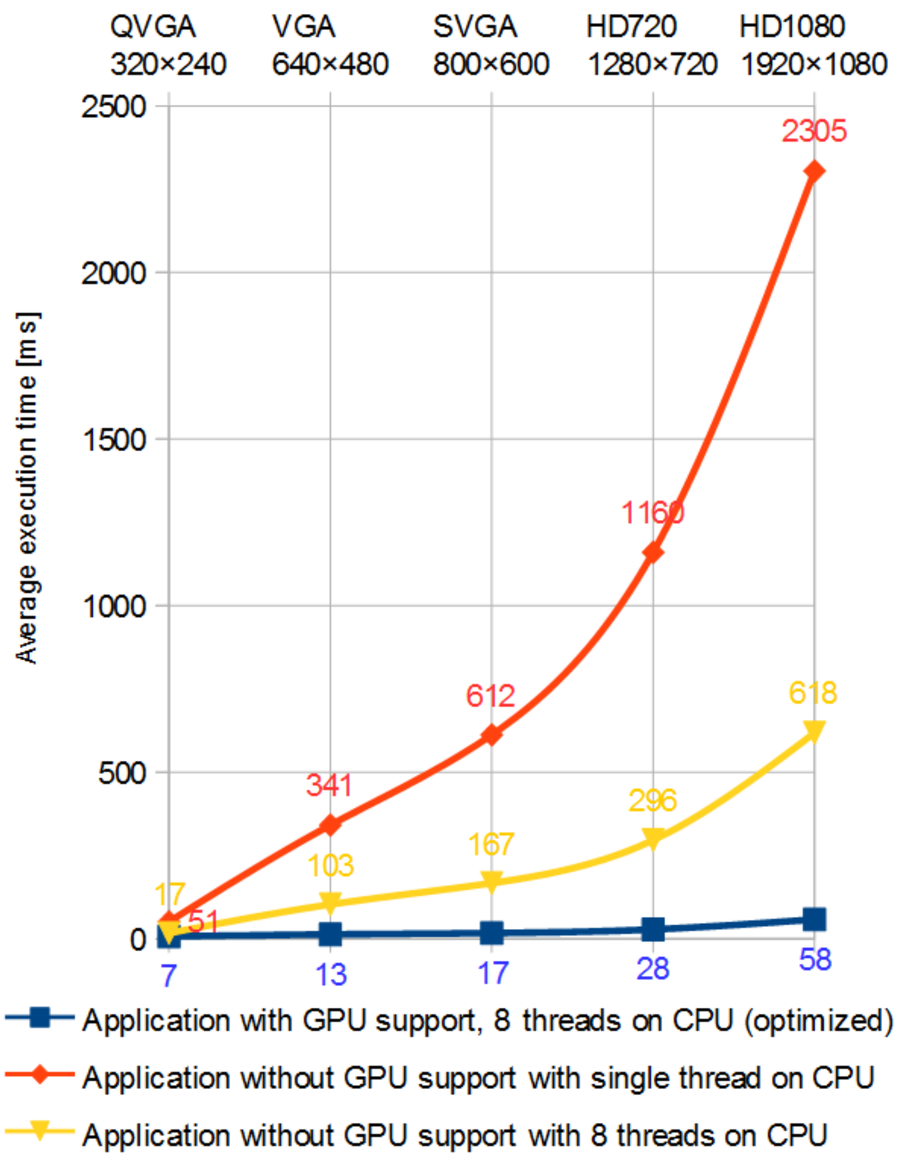
EXPERIMENTAL RESULTS

ACCURACY

Approach		Vehicle count per lane		
		Total	Left	Right
Overlap check	Hits	126	65	61
	FP / FN	0 / 6	0 / 5	0 / 1
	Accuracy	95,6%	92,9%	98,4%
Trajectory check	Hits	129	68	61
	FP / FN	1 / 4	0 / 3	1 / 1
	Accuracy	96,2%	95,8%	96,8%
True vehicle count		132	70	62

EXECUTION TIME





CONCLUSION & FUTURE WORK

- Developed system uses only one camera to detect and track vehicles on a road with multiple lanes
- First testing results are promising with vehicle detection accuracy of over 95%
- Future work consists of developing a multiple object tracking system which would estimate vehicle trajectory based on a vehicle model with dynamics included; perform vehicle classification and therefore separate vehicles by their type

COMPUTER VISION INNOVATIONS FOR SAFE TRAFFIC (VISTA)

- Faculty of Electrical Engineering and Computing (UNIZG-FER) leading institution
- Faculty of Transport and Traffic Sciences (UNIZG-FTTS) partner institution
- Development of:
  - Detection of road-side vegetation for traffic infrastructure maintenance
  - Surround-view parking visualization
  - Traffic sign detection and recognition
  - Lane detection and recognition
  - Lane departure and collision warning
  - Automatic headlight detection
  - Driver mental state recognition

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