Real-time Vehicle Matching for Multi-camera Tunnel Surveillance

Vedran Jelača

Supervisor(s): Aleksandra Pižurica, Wilfried Philips

I. Introduction

This paper addresses the problem of matching vehicles as they are imaged by stationary cameras with non-overlapping views, for the traffic surveillance in tunnels. Since such systems can contain hundreds of cameras which observe dozens of vehicles each, computational efficiency is essential. Our work is focused on extraction of simple, yet informative and robust descriptor of the vehicle appearances from their images and matching of the extracted descriptors to identify vehicles in different cameras.

II. Proposed method

We propose a vehicle appearance representation based on signatures that are horizontal and vertical Radon transform like projection profiles of the acquired vehicle image (see Fig. 1). Matching of the signatures from different observations is done by a simple combination of 1-D correlations. One signature is shifted over the other and the maximal correlation coefficient is their matching measure. The final similarity measure of the vehicle images is calculated as a module of a 2-D vector formed by correlation values between the corresponding vertical and horizontal signatures. Experiments on 300 vehicle images extracted from real tunnel videos validate our approach and show better performance than other methods (2-D image correlation, SIFT [1], eigenvectors [2]). Our method has similar or better accuracy, yet it is computationally much more efficient.

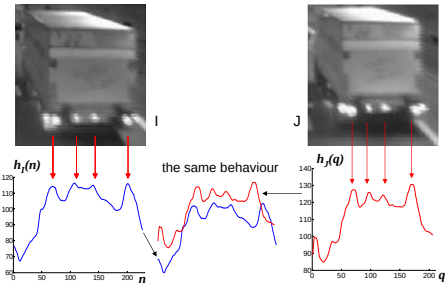

Figure 1. Vehicle images from two cameras and their horizontal signatures. Signature peaks correspond to the brightness changes of vehicle parts and patterns. There is a clear similarity in behaviour of the signatures.

III. Conclusions

Our method significantly reduces the amount of data and computations needed for vehicle matching. Hence, it can be used for vehicle matching on embedded systems (e.g. smart cameras) or on a central server without a need for sending the images between the cameras or to the server. This significantly reduces requirements for communication links capacities and processing power.

References

[1] Lowe, D., *Distinctive image features from scale-invariant keypoints*, International Journal of Computer Vision, 2004.

[2] Turk, M. and Pentland, A., *Eigenfaces for recognition*, Journal of Cognitive Neuroscience, 1991.

V. Jelača is with the Department of Telecommunications and Information Processing, TELIN-IPI-IBBT, Ghent University, Ghent, Belgium.