

1. Introduction

Viola-Jones approach is widely used, however a large amount of training samples is needed to train a detector. For some problems this imposes a significant obstacle. Very often a high rate of false positives is obtained which is another drawback. Color-based techniques are not resilient to variably illumination or shadows which are common in real-world. Those shortcomings can be overcome by using a technique that employs features that are robust towards light change and in the same time meets real-time requirements.

2. Brief overview

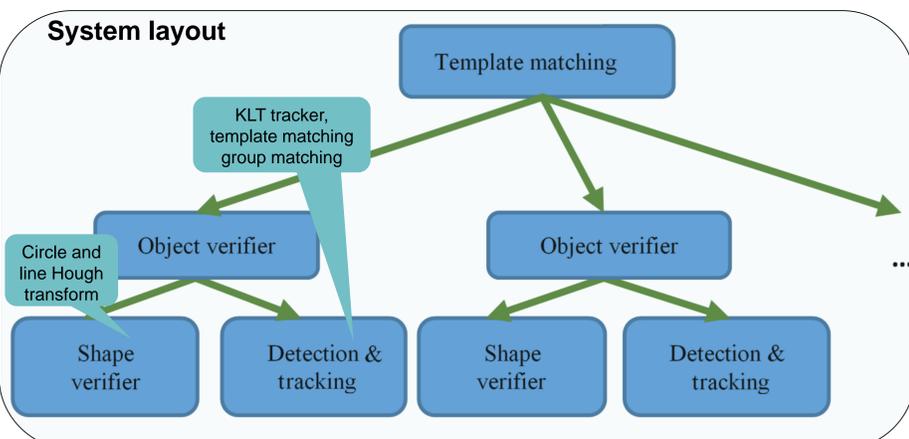
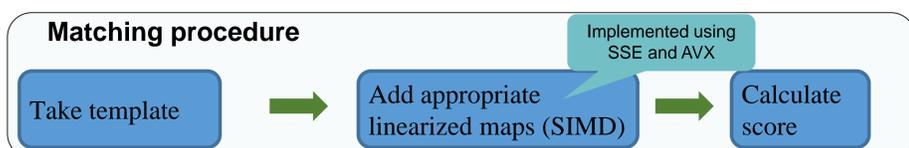
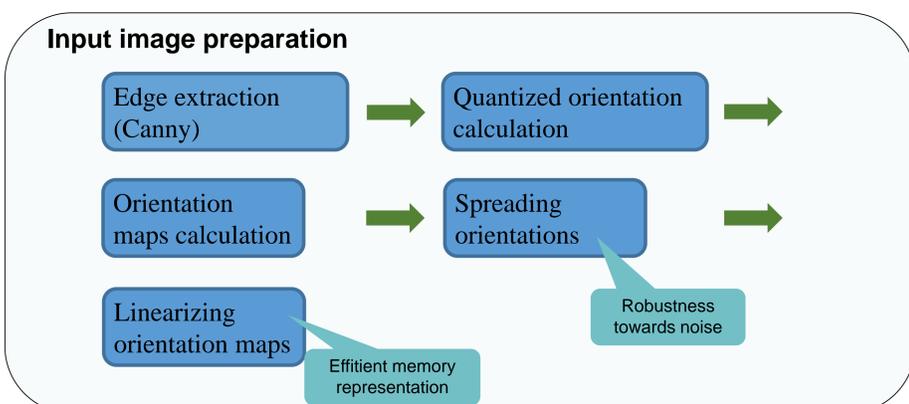
A novel method for traffic sign detection which does not require extensive training and which is based on edge orientation gradients is presented. A fast and robust algorithm for template matching [1], which outperforms standard procedures in a way of speed and accuracy, is used. Post processing phase enables detection verification thus drastically increases detection accuracy. The method shows robustness to various conditions that often impose problems for color based systems. The proposed method can be used standalone or as a verification layer with already developed methods.



Figure 1. Currently supported traffic sign shapes

3. Method

The main part is modified (edge detection, AVX instructions), template matching procedure from [1]. Post processing phase relies on shape recognition (Hough transform) and tracking which ensures detection stability and rules.



4. Results

The proposed technique is evaluated as a standalone detection system. Video resolution was set to 500x360. The average frame processing time is ~30 ms. The main template matching phase was also evaluated separately.

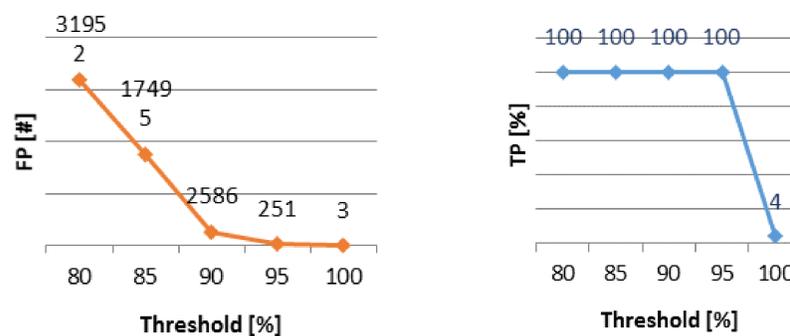


Figure 2. Performance of the system using only template matching method. Left graph shows number of false positives in relation to the threshold. Right graph represents the true positive percentage in relation to the threshold.

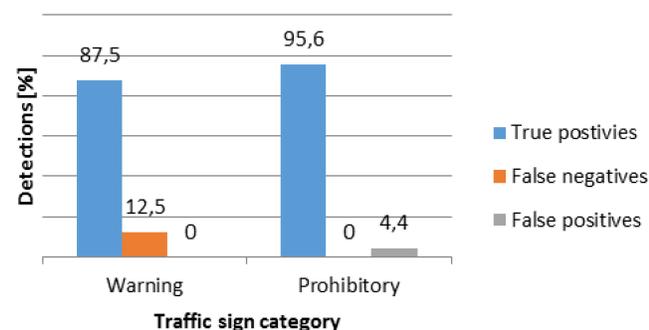


Figure 3. Performance of the system using all proposed stages.

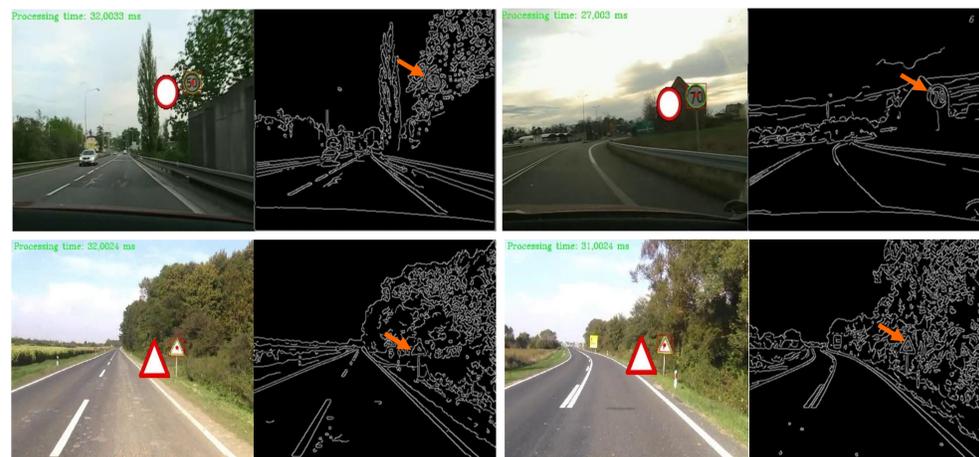


Figure 3. Warning and prohibitory sign detection. Each pair represents application output and magnitude image (what template matching algorithm actually sees) respectively.

5. Conclusion

This paper presents a method for detection of prohibitory and warning signs, although it could be easily extended to detect other types. A fast template matching algorithm which has been proven to be adequate for this task is used. The system has a post-processing stage which consists of several verifiers: continuous detection with tracking verifier and shape verifier. Although there are no other cues except edge-based ones system achieves good results in terms of performance and true positive rate.

[1] Stefan Hinterstossier, Cedric Cagniard, and Peter Sturm, "Gradient Response Maps for Real-Time Detection of Texture-Less Objects," Pattern Analysis and Machine Intelligence, 2011.