A Coarse-to-fine Strategy in Recognising Logos of Cars

S. Sotheeswaran and A. Ramanan
Department of Computer Science, University of Jaffna

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1. Introduction

Car logo recognition (CLR) is used to recognise accurately the manufacturer of a car by using its iconic logo. A CLR system in addition to license plate recognition aims to increase the confidence of vehicle monitoring systems in private environments.

The proposed method uses a coarse-to-fine (CTF) strategy in detecting a car towards its logo from an input image.

2. Objective

To propose a CTF strategy that first detects the bounding box of a car, then the grille and at last the logo. The detected logo will be then recognised for the make of a car.

3. Methodology

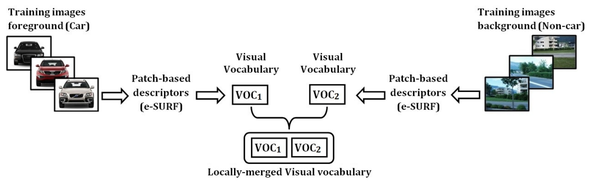
Our contributions in recognising logos of cars:

1. Detection of the bounding box of a Car
   ⇒ using vocabulary voting and mean-shift search
2. Detection of the grille of a car
   ⇒ using HOG + SVM
3. Localisation of Logo
   ⇒ using Haar+AdaBoost+Cascade classifier+CHT
4. Recognition of Logo
   ⇒ using a Classifier-free vocabulary-based method

3.1. Front-view Car Detection

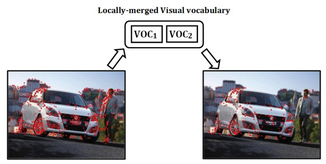
Vocabulary construction

The workflow of constructing visual vocabularies for foreground and background objects:



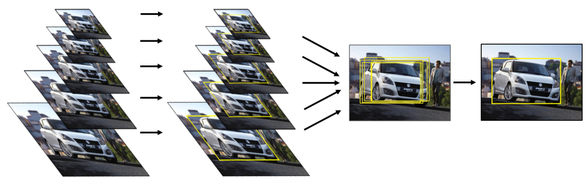
Vocabulary voting

When an unseen image of a car is produced to the system, e-SURF [1] descriptors are extracted from it. Then the foreground keypoints are retained using vocabulary voting strategy.



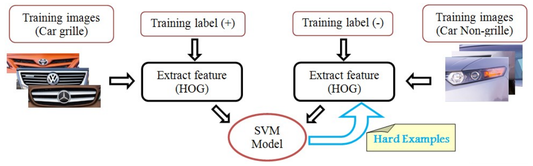
Scale-Adaptive Mean-Shift Search

Detecting the bounding box of a test image using scale-adaptive searching method and non-maximum suppression technique.



3.2. Car Grille Detection

Car grille is detected using HOG features [2] and SVM classifier.



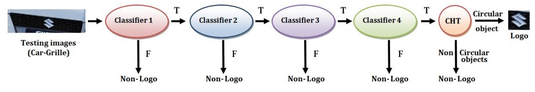
Creating a model to detect the Car-grille

Scale-adaptive sliding window search

3.3. Car Logo Localisation

Viola-Jones [3] and Circular Hough Transform:

Extracted features are selected using AdaBoost Classifier

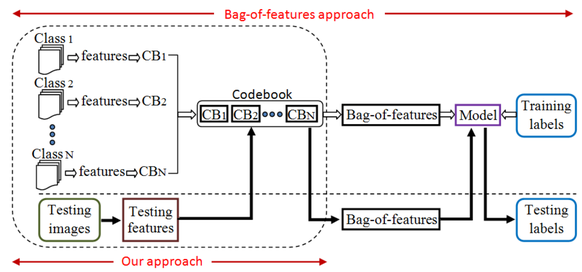


Localisation of the logo using cascade classifier and CHT.

3.4. Car Logo Recognition

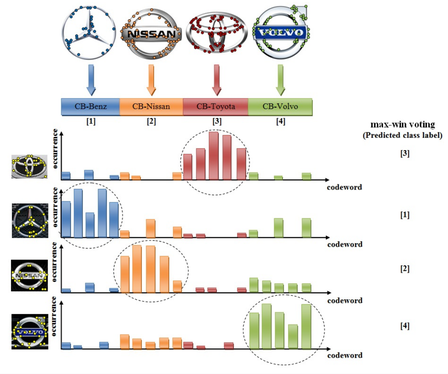
Vocabulary based classification method

The proposed classification technique is free from the histogram representation of patch-based descriptors.



Bag-of-features (BoF) vs Our approach.

We propose a classifier-free vocabulary-based image classification technique which employs a nearest neighbour max-win voting strategy on a learnt class-wise vocabularies of logos to predict the class label of a given test image.



4. Dataset

We obtained images of 25 distinct classes of front-view cars with 20 images per class from Google Images with size of 800 × 600 pixels with no preprocessing.

Example car images of our image set.

5. Experimental Setup

Size of visual vocabulary= 2000 (i.e., $|FG|=1000$, $|BG|=1000$).

$$\text{No. of scale steps} = \text{floor}\left(\frac{\log\left(\frac{s_e}{s_s}\right)}{\log\left(s_r\right)} + 1\right) \quad (1)$$

$$s_e = 3; s_s = 1; s_r = 1.06$$

We make use of a threshold θ to reject false prediction of bounding boxes. The θ is estimated to every possible bounding box b using the equation (2):

$$\theta = \frac{\#\text{Car keypoints detected inside } b}{\#\text{keypoints detected inside } b} \quad (2)$$

Threshold: $\theta = 0.52$

6. Results

$$\text{True detections}: \frac{\text{area}\left(B_p \cap B_{gt}\right)}{\text{area}\left(B_p \cup B_{gt}\right)} > 0.5 \quad (3)$$

$$\text{rate} = \frac{\#\text{True detections}}{\#\text{Total testing images}} \times 100\% \quad (4)$$

	Car Detection	Logo Detection	Logo Recognition
Rate	98.0%	90.8%	86.4%

7. Discussion & Conclusion

We have proposed an approach to localise the logos of cars using a CTF strategy and then recognise the make of the car by using a classifier-free vocabulary-based approach which not only speeds up the recognition process but also reduces the storage requirement when comparing with the traditional BoF approach.

References

[1] H. Bay, A. Ess, T. Tuytelaars, and L. V. Gool, "SURF: Speeded Up Robust Features," In Computer Vision and Image Understanding, vol. 110, No. 3, pp. 346-359, 2008.
[2] N. Dalal, "Finding people in images and videos," PhD thesis, France, 135pp, 2006.
[3] P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features," In proceedings of the Computer Vision and Pattern Recognition (CVPR), pp. 511-518, 2001.