Logo Classification of Vehicles using SURF based on Low Detailed Feature Recognition

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ABSTACT

In today's world a need for brand identification has become more important ,as it could be used for classification of certain brands or even in the artificial intelligence it plays an important role . This paper presents a model for car brand recognition. An input for this method is a car surveillance video obtained from the real time environment. The method used is a invariant key point Descriptor. The invariant keypoint descriptors does not change the vector value even if the image is scaled or rotated .This approach boosts the recognition accuracy compared with that of the standard SIFT based feature matching. The approach used for brand identification has been presented with results.

Keywords

SURF,SIFT ,Invariant key point ,Hessian matrix, feature vector

1.INTRODUCTION

Vehicles in today's era has varying number of features for distinguishing themselves and presenting in a unique manner. The car design and the varying models presents interesting features.This paper presents a model for car brand recognition. The aim of this proposed work is to provide information about car type as it approaches the surveillance region. Three common brands namely "Suzuki", "Toyota", "Hyundai" are analyzed. A common method of approach is to locate keypoints from the frames of the video and compare them through the descriptors of the obtained features. Invariance is the most important factor of the key point detectors.

open SURF library that is integrated into the MFC application along with openCV could be a good solution for analyzing the features. SIFT method could also be used for the same problem for brand detection[5]. Though it gives good results but the average percentage of the successful identification was not high. There are three steps involved for SURF detection and matching:

- Interest point detection
- Feature vector retrieval
- Vector matching or Descriptor matching

2. VEHICLE LOGO DETECTION

A Captured video is converted into frames and sent as input to the SURF detection module. Here the descriptors are obtained as a vector. The frames captured in various illumination condition and rotated versions achieves the success rate of 96.5% for logo segmentation [5].

A. Interest point Extraction and localization

A Fast Hessian feature detector is used by SURF. The Fast Hessian detector is based on the determinant D(*H*) of Hessian matrix H(*f*).Hessian matrix consist of partial derivative of two dimensional function f(*i*,*j*) as described in[1][3].

$$H(f(x,y)) = \begin{bmatrix} \frac{\partial^2 f}{\partial x^2} & \frac{\partial^2 f}{\partial x \partial y} \\ \frac{\partial^2 f}{\partial x \partial y} & \frac{\partial^2 f}{\partial y^2} \end{bmatrix}$$

The matrix determinant is calculated by

$$det(H) = \frac{\partial^2 f}{\partial x^2}\frac{\partial^2 f}{\partial y^2} - \left(\frac{\partial^2 f}{\partial x \partial y}\right)^2$$

The determinant computation is necessary for interest point detection for scale space is continuous that can be used to find the extremes across all possible scales[2].In SURF we need not to resize the images as in SIFT ,an image pyramid is used where the input image is iteratively convolved with the Gaussian kernel as shown in Figure 1 .convolution mask is re-sampled to ensure size invariance.

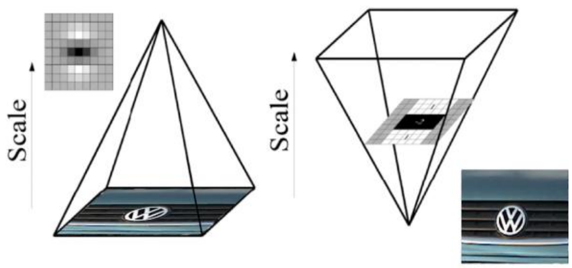

Figure 1.Pyramid for the SIFT and the SURF

B. Interest Point Descriptor

The SURF descriptor shows how the pixel intensities are distributed in a scale dependent neighborhood of each interest point that is obtained by the Fast-Hessian matrix[1].The descriptor extraction involves two steps(i)First an orientation that can be reproduced at each interest point is assigned (ii)Secondly for each interest point a square window in appropriate scales is constructed .This window consists of 64 value vectors which is computed for the given interest point. The SIFT extracts 128 values for one interest point compared to SURF Descriptors.

C. Vector Matching

If the vectors of database items and new input are known ,,then they are matched with each other. For Each key point from the given input image find the keypoints from the database with the smallest distance(Mean Squared Error).Two key points are said to be matched if the distance to the next closest descriptor is smaller than the the factor of α . Count the number of descriptors successfully matched.

The main purpose of image preprocessing approach is that it contains all the necessary information , but the size of the image remains as small as possible. The car logo is just a small portion of the image compared to the whole Image. Reducing an input image to the region around car logo has a positive result .Lower number of detected interest points leads to more accurate computation and improves the execution time.

3.EXPERIMENT

The database built includes 50 images. To the given input, we have detected and extracted the feature points of interest. To those detected interest points, matching was performed with the given dataset. Depending upon the number of matching points, classification has been performed for the given input under which classes of brand it belongs. After classification, it has been evaluated with the performance of the classification output by precision and recall parameter that has been show in graph in Figure2. The screen shots of the best matches found during the matching phase of the SURF detection .

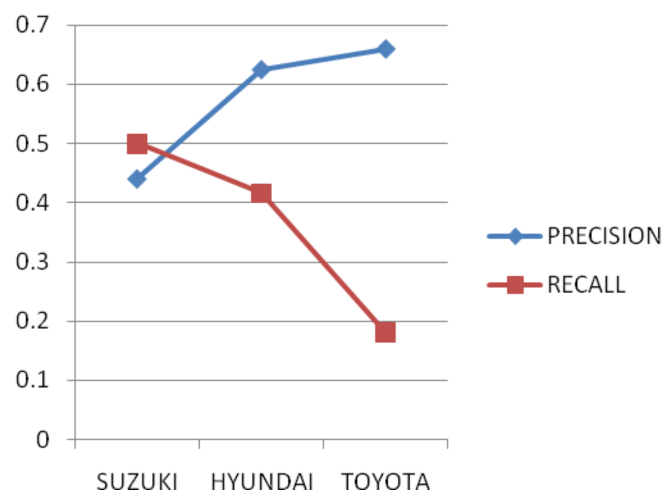

Figure 2. Graph of Brand name with Precesion and recall along x and y axis respectively.

Table 1:Precision and Recall values obtained result

Brand	Precision	Recall
Suzuki	0.447	0.5
Hyundai	0.634	0.412
Toyota	0.672	0.192

Fig 3:Matching points found for a given template image and the input frame

Table 2:Description of the obtained result

CLASS	**BRAND NAMES**		
	SUZUKI	*HYUNDAI*	*TOYOTA*
True Positive	0.2667	0.3333	0.1333
False Positive	0.2667	0.4667	0.6000
True Negative	0.0667	0.0000	0.2000
False Negative	0.4000	0.2000	0.0667

4. CONCLUSION

In the proposed work an investigation on how SURF-descriptors can be used to detect a car brand.The SURF descriptors are faster compared to that of SIFT which is very useful in terms of real time application .As the α values is increased from 0.6 to 0.8 we could that the accuracy of the SURF point detection increases and gives the best match . The final output is not very high .The main idea is to find an alternative method and obtained some valuable results .As a future work templates need to be developed , the number of brands need to be increased and a database to store the vehicle information . For the brands which were detected poorly there is a need to find a method to increase the interest points i.e. instead of using a maxima minima points we can use saddle points to extract the interest points.

5. REFERENCES

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