A NOVEL APPROACH FOR VEHICLE RECOGNITION BASED ON THE TAIL LIGHTS GEOMETRICAL FEATURES IN THE NIGHT VISION

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ABSTRACT:

A novel approach for vehicle recognition is prepared using geometrical features of tail light like location, size and variations in the night vision. In the night vehicle tail light appear much more brighter and it is having the unique features which distinguish the vehicle belongs to a specific brand. A specific probability is computed for each model integrating the posterior probabilities of all the tail light shapes using the geometric mean for recognition of vehicles.

Keywords: Feature Extraction, Tail Lights, geometrical features, Recognition

[1] INTRODUCTION

Vehicle make and model identification is a challenging task due to the amount of car models, including different car manufacturers and models growing year by year. Several automatic vehicle model detections were proposed but still it is not completely solved the task, the need for a full vehicle identification approach is getting more relevant due to the increased demand for effectiveness and security. It is most essential in Current traffic surveillance applications, speed and access control platforms, automated tollgate systems, etc., rely on the use of License Plate Recognition (LPR) systems that provide a unique and poor identifier in recognition of vehicle. This proposed work would enhance current vehicle...
identification systems. Besides the license plate, vehicle colour, plate colour, car make and finally, the car model, are representative variables of the vehicles. This may lead to new prospect for automatic detection of vehicles with various possibilities such as avoiding improper fines to drivers due to LPR errors, enhancement of vehicle recognition in night vision etc.

The majority of existing vehicle make and model methods are designed to be used only in daytime when most car features can be easily seen [4], [5], [6]. Few methods have been developed to cope with limited lighting conditions at night where many vehicle features cannot be detected. This work identifies car make and model at night by using available rearview features [7], [10]. The salient geographical and shape features of taillights from the rear view are extracted and used in the recognition process. However, since the illumination is low at night and the vehicle light intensity rapidly changes, the vehicle detection methods for day cannot be applied to that at night. The main difficulties of vehicle detection at night are: 1) No more constant sunshine light at night; 2) Since weak light, the vehicle information available is less; 3) because of random illumination, vehicle image rapidly change, it’s hard to build a stable vehicle model. Hence for all the above difficulties the brightest region visible of the vehicle in the night in tail lights. The proposed work considers the tail lights as the region of interest. The features of interesting region are extracted, then the features of the region used to recognise the vehicle.

[1.1] LITERATURE SURVEY

Li-Chih Chen[5] et.al, presents A novel symmetrical transformation is proposed to enhance the power of the SURF scheme to detect symmetrical objects from videos for various applications. A new vehicle detection scheme is proposed to detect vehicles from moving cameras. Its advantage is no need of background modelling and subtraction. Dileep M.R and Ajit danti[1], [2] presents a novel approach for extraction of geometrical features of the face like triangular features, Orientation, Perimeter, and Distance for face recognition and person’s internal emotional states which is very much useful in proposed technique. Raghavendra S P and Ajit danti[10] presents a novel recognition of indian bank cheques using feed forward Neural Network based on the geometrical features of the bank cheque is the one which is the outcome of the type or category of the cheque which belongs to a specific bank

Here, four Indian vehicles viz Hyundai, Honda, Suzuki and Renault are considered. The probability of finding these vehicles in any of the image is more compared to the above methodologies proposed by different researchers [3],[4],[6] to [15]. This work is not limited to a single database, but also can be applied to different databases and also the images downloaded from the internet.

In this paper, the algorithm has been proposed to recognize the Indian vehicles using template matching. Systematic comparison is done using geometrical features of the segmented tail lights of a vehicle. The paper is being developed as follows. Section 2 tells about the feature extraction of tail lights for experiment. Section 3 briefs about the proposed methodology algorithm. Section 4 highlights implementation of proposed algorithm. Section 5 gives the experimental results. Finally, conclusions are given in section (6).
2] PROPOSED METHODOLOGY

The proposed methodology consists of three primary steps in the image processing algorithm. The first step consists of some pre-processing applied on the input image for detecting interesting features, on the image in the dataset. The fiducial points represent interesting features of objects in the image. We assume that the image includes a car object and be of the same size in pixels to eliminate the need for a vehicle detection scheme and to improve feature matching, respectively. Features that are detected will be from both the car and the background scene.

In the second step, fiducial points of the segmented image are undergone with some morphological operations to extract some geometrical features like area, elongation, solidity and centroid. This process is repeated for different samples belongs to the same class in the dataset. Then features of all different classes will be stored as templates.

In the final step, fiducial points of test image features are extracted by repeating the second step. Then the geometrical features of segmented region are calculated mean distance with knowledge base consists of trained features of the different vehicle models. The best matched result is identified based on that vehicle make and model is recognised. The pictorial representation of the proposed methodology is shown in the below diagram.

An algorithm for vehicles make and model recognition is proposed to recognize input images into one of four models viz Hyundai, Honda, Suzuki and Renault mean distance. In the first stage, geometrically invariant features viz centroid, eccentricity, convex area, Euler number, solidity are determined using the following equations (1) to (5).

\[ \text{Centroid } (C_{x,y}) = \begin{cases} 
C_x = \frac{1}{N} \sum_{i=1}^{N} x_i \\
C_y = \frac{1}{N} \sum_{i=1}^{N} y_i 
\end{cases} \]

Where x and y are horizontal and vertical coordinate.
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\[ eccentricity(c) = \left( \frac{c}{a} \right) \]  

Where \( c \) is the distance from the centre to a focus, \( a \) is the distance from that focus to a vertex.

\[ Euler\ number = (S - N) \]  

\[ Solidity = \left( \frac{A_v}{A_t} \right) \]  

\[ elongation = \left( \frac{m_j}{m_n} \right) \]  

Where \( m_j \) is major axis and \( m_n \) is minor axis of tail light region

These features are geometrically invariant of size, scale and orientation. The tail light features are searched randomly from the image based on elongation constraint which is well under the bounds threshold value considered as the potential shape candidate. Later they are compared with knowledgebase by statistical mean calculation and correlation using equation

\[ r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \]  

Where \( \bar{A} \) = mean2(A), and \( \bar{B} \) = mean2(B)

[4] PROPOSED ALGORITHM

Proposed algorithm for vehicle recognition the given Query vehicle image is as given below:

Input: Input Query vehicle image

Output: Determine vehicle class Hyundai, Honda, Suzuki and Renault.

Step 1: To Train, input all vehicle tail light images to a knowledgebase with four invariant features.

Step 2: Segment the potential tail light region by selecting randomly, and extract features using equation (1) to equation (5)

Step 3: Set the Target for the recognition of four categories of vehicle brand.

Step 4: Create & Train the knowledgebase using templates.

Step 5: Create knowledgebase, for all tail lights features.

Step 6: Determine the index for maximum value using the equation (6) and this value will constitute the type of class for which the query tail light image belongs.

[5] EXPERIMENT RESULTS

The evaluation of the proposed inference approach is carried out separately on each car manufacturer test data set. Results are given in Tables 1. Table depicts the brand, the shapes of tail lights of each one of the models, and the accuracy. An overall accuracy of 79.25% is obtained. Most of the errors provided by the system are mainly due to classes with similar geometry and appearance. In addition, we can expect lower accuracy in real conditions due to errors in the car make recognition system, which can be considered as a critical error,
and errors in the captured picture quality, which will produce inaccurate normalisation transformations. This will be analysed in the future work.

Figure 2: Sample images with Segmented Tail Lights

Figure 3: Experimental results for recognition of Vehicle model using Tail Light

Table 1: Success rate for different vehicle models
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[5] CONCLUSION

This paper presents a novel approach in accomplishing Make and Model Recognition for images of cars with an arbitrary angle of view. Experimental results show the efficiency of the proposed approach with an average success rate of 79.25%. Car make and model recognition is a fairly unexplored field in machine vision, but some progress has been made in several areas that can help further work. Future work on this project should focus on improving the interest point matching results and the building of the database image reader and comparator to a query image to find the best match.

REFERENCES

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