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Automatic template logo segmentation and recognition of vehicles

Yan Naung Soe, Khet Khet Khaing Oo

University of Computer Studies, Myitkyina, Myanmar

ABSTRACT

An automatic system for vehicle and traffic control is essential for concessive increasing car usage. There are numerous numbers of application systems for a car number plate recognition system. But to recognize the car, it needs to consider other kinds of attributes such as car color and logo to avoid the fake license. This system tends to segment the car logo or trademark and then the segmented logo is classified. It implemented using the frontal image of Vehicles and it will be tested the car which is used in Myanmar. The metallic part is segmented from the front view of Vehicle by using region growing method in the reduction of searching space. The bounding box is defined according to the segmented metallic part. After that the logo localization via bounding box, it is segmented using morphological operators such as opening, closing, dilation, and erosion. The segmented logo is recognized by using the Template Matching Method using correlation coefficients.

Keywords— *Mmorphological, Dilation, Erosion, Template Matching Method*

1. INTRODUCTION

Vehicle recognition have been applied in monitoring and management of traffic , assistance to drivers, recognition of license plates for public security, pollution control, entrance in private environments [3, 15]. The classification of vehicles is a basic task of all monitoring systems but Vehicle Logo Recognition system is an advanced image processing and pattern recognition system which identifies the plant of a vehicle from its captured image [21]. License plate number plate is one of the information for distinguishing cars. Automatic license plate recognition system is one of the most popular methods which have been done in this field but the problem with number plate is that it can be forged, covered or missing. In that case identification of vehicles through number plate is rendered useless [4, 18]. Important information of a vehicle is its logo. The iconic vehicle logo is the trademark of a vehicle and a symbol of automobile brands. Vehicle logo is a label of the car and contains important information about the car. Because car logo exchange is very difficult, it provides a crucial basis for classifying and identifying a car [2, 8]. Automatic logo recognition system can be applied in various applications. Some example will be mentioned in the following. Firstly, it can apply Recovery of Stolen Vehicles in which the thief generally forges the number plate. But logo cannot be changed hence through Vehicle logo Identification System reduce the sample space for the suspected cars. Secondly, it can use in Allotting parking zones. The problem of parking is increasing day by day. Some system also tried to recognize the color of vehicle for car identification [1, 11]. Now, some companies are pioneers in Light Motor Vehicle manufacturing and some companies manufacture heavy vehicles like Volvo. Hence by identification of model, LMVs and HVs can be allotted different parking zones hence saving space [18]. Thirdly, it can also apply in Traffic Lane Classification. Just like earlier point some companies manufacture fast cars (like Lamborghini, Porsche etc.) who have a high average speed and some companies manufacture normal cars (like Honda, Suzuki etc.) with a normal average speed. Thus by knowing the model of vehicle different lanes can be allotted to them, thus preventing accidents [13].

One can also use Vehicle Logo Identification System for surveying an area to find out which models of vehicles are popular in a particular region [6, 9].

This system uses the frontal image of Vehicles and it will be tested the car which are used in our Myanmar. The metallic part is segmented from the front view of Vehicle by using region growing method in the reduction of searching space. The bounding box is defined according to the segmented metallic part for logo localization. The logo is segmented using morphological operators [10, 15]. The segmented logo is classified using the Template Matching Method. Automobile has become one of the most important modes of transportation [21]. The number of cars increases year by year. So, traffic control including the tracking and identifying the car play vital role for our country. To support the system of the automatic systems for the traffic control mainly in private parking lot like those in shopping malls, universities or companies and to support the system of detection vehicles with cloned license plates from comparison between collected data and the official register of the local transit agency, Segmentation of vehicle logo from the given image is also very important in Vehicle Model Identification [17]. There are so many objectives in this thesis but the main ones are to design and implement the automatic logo Segmentation System and to apply morphological processes in Vehicle Trademark Segmentation. It also tend to extract unusual characteristic of vehicle (logo) aiming to increase the automatic systems for traffic control.

2. LOGO SEGMENTATION AND RECOGNITION SYSTEM

This system extracts the logo of vehicle from that frontal car images and then the segmented log is defined with their

respective class. Car logo localization, logo segmentation and logo recognition are carried out using region growing method, bounding box, morphological image processing and pattern matching.

The first step for the logo segmentation is the reduction of searching space, using, a binary image resulting from Metallic part segmentation. The logo is normally located between the metallic part and the license plate. After segmentation of Metallic part, the logo localization continues to carry out two operations, Morphological image processing.

The metallic frontal part is segmented by region growing [5, 19]. The input car frontal image is converted to gray-scale for a simpler segmentation as in figure 1.

Fig. 1: Gray Scale image

For region growing, the user gives a point as a seed point to segment the metallic part. After metallic part segmentation, it reduces the searching space of logo because the logo is normally located between the metallic part and the license plate. It can define the searching space of bounding box related to the metallic part. Considering the bounding box of this region and supposing p1 as the pixel in left-top and p2 as the pixel in right-bottom corner, a reference pixel p or (px, py) can be defined as to follow:

$$py = p2y;\ px = (p1x + p2x)\ \text{div}\ 2 \qquad (1)$$

Finally, there is a region around of the pixel p that can contain the logo. In tests, a distance sufficiently great d is defined in relation to bounding box dimensions of the metallic part:

$$d = \max\ 1/6\ (p2y - p1y);\ 1/2\ (p2x - p1x) \qquad (2)$$

The new searching image is created, considering 2d pixels of lines below the pixel p, and d pixels of lines above p. And 3d pixels of columns to left and right from pixel p.

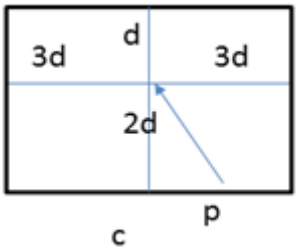

Fig. 2: Bounding Box for Logo Localization

The result of bounding box after metallic part segmentation, the system found the logo area as in figure 3.

Fig. 3: Logo Area

Normally, there is high contrast between the logo material and the background too [7]. Enhancement darker pixels inside logo region: thresholding with 50 is applied if difference is greater than 50, the pixel becomes 1, and otherwise it becomes 0 as in figure 4. Morphological closing by a horizontal line as structuring element as in figure 5. Sub-traction of original image from closed image is processed to get logo parts as in figure 6. But it still remains other unwanted segmented part. Among these segmented regions, the region area between 80 and 160 are chosen.

Fig. 4: Thresholding Process

Fig. 5: Mophorlogical Closing

Fig. 6: Subtraction Logo Part

The logo is selected from the remained components. Amongst these regions, it chose that is closest to reference pixel p defined in Equation 2 because it has great possibility as a vehicle logo. The segmented logo is shown in figure 7.

Fig. 7: Segmented Logo

Pattern matching technique is used to recognize the segmented logo [21]. It includes a simple but fast correlation based template matching algorithm. The correlation coefficient calculation is implemented with convolution technique. The correlation coefficient calculation is implemented with conv2. Function *corr* is relatively slow for template matching purpose and it is also required extra considerations on controlling the boundary and selecting region of interest on the frame image. However, by using conv2, the template matching speed has been accelerated and run-time has reduced to a reasonable value [20].

3. ARCHITECTURE OF SYSTEM

The data flow diagram of the system is as shown in Figure 8. The input to the system is the car frontal RGB image. The metallic part of the vehicle is segmented by region growing

method. Based on that part, the bounding box is created for reducing the searching space. After that, morphological operators are used to segment the logo. Pattern matching technique is used to classify the type of car [14].

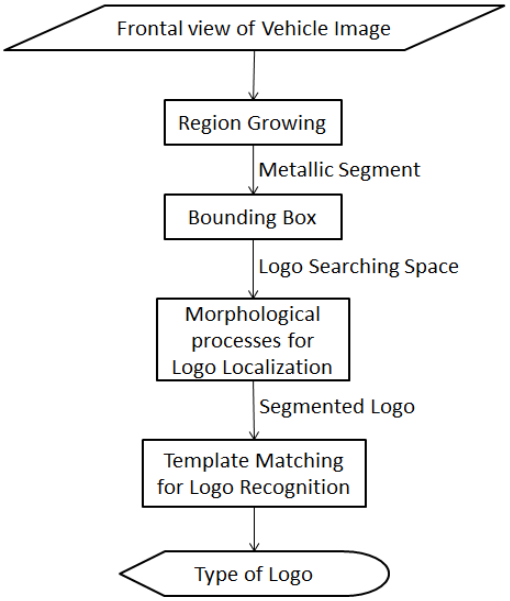

Fig. 8: Architecture of the System

4. CONCLUSION

This system implement for the automatic segmentation of a vehicle logo. Morphological operation used as a key step to enhance the area of logo for segmentation. And metallic part segmentation applied to help for defining logo region. The segmented logo is recognized using pattern matching. Correlation coefficient method in template matching is used for recognition.

This system can only recognize four types of car which are mostly used in Myanmar. Only the frontal car images are classified for type of cars. It only extracts the logo and type of car plant. Car logo segmentation is difficult because the logo is usually made up of metal color and it is similar with the car body. According the color of vehicle like gray or white, it is hard to detect and segment the logo. This system can extend to extract other attributes of vehicle like color, model to support the automatic vehicle identification system. The car frontal images are distorted by the reflection of noise to split the metallic part. So it should add a method which can filter the reflection before further processing of logo segmentation and recognition.

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