

Detection of Brazilian License Plate Region for different classes of Images

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Abstract

In this work we present an adaptive method for detection of Brazilian license plate. This method enhances adaptively an input image, improving low contrast areas and guaranteeing a good contrast in the plate region. Based on the fact that license plate's area is rich in texture and vertical edge information, we can identify it after filtering the image with Sobel and Canny operators eliminating longer and shorter edge segments, which can be considerate noise. Finally a counting box window is used to locate the character region with the maximum vertical edge information. At last we present an analysis of the method using a large image database with different classes of plate images.

1. Introduction

This paper proposes a method to detect the location of license plates in images taken by an electronic toll collection system of a private company exploring a public concession. Several factors can confuse the plate detection, such as complex structures in the image, non-homogeneities of image illumination, weather conditions and car's color.

Many techniques for plate analysis have been developed over the years, but they are mainly focused on character recognition of license plates: Gesualdi et al. [1] used neural networks and Syed and Sarfraz [2], used fuzzy segmentation as recognition approach. In a previous work, [3], the procedure was to calculate the region based on the wide luminance variation property of plate image. Yang et al. [4] used histograms and mathematic morphology.

Zheng et al. [5] developed a method to identify the license plate location which enhances the input image adaptively, extract vertical edge information and uses a counting box method to choose the probable plate location. They obtained an impressive result for Chinese license plates and it is considered here to be adapted and tested for Brazilian license

plates. Both methods differ in the enhancement and vertical edge detection procedure mainly due to the differences between the license plates layout.

2. The proposed method

The proposed method searches the license plate according to an estimated window size. The input image is submitted to an adaptive enhancement filter which improves low contrast regions defined by an interval of the standard deviation range from the gray levels of the whole image.



Figure 1. Example of a typical input image.

License plates have a great quantity of vertical edge information normally corresponding to characters. These characteristic can be used as the main resource to locate the license plate. Adapting the method proposed by Zheng et al. [5] for Brazilian license plates, we added a pre-processing stage to improve edge extraction using Canny operator. After the edge extraction stage we eliminate much longer and shorter edge information, which are considered noise for this work (fig.2).

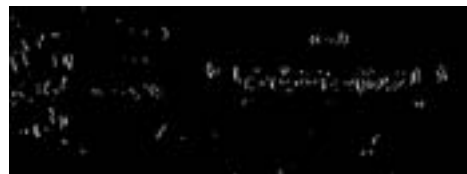


Figure 2. Image after removing much longer or shorter edge information.

The final stage of the method convolves the input image with the estimated window area, as shown in

figure 3. The biggest value in the resulting procedure is elected as the license plate center, and can be compared with a cataloged image database center value in order to evaluate the whole process. With this center plate value and the window size defined it is possible to crop the license plate from the input image, as shown in figure 4.



Figure 3. Resulting image after convolution process.



Figure 4. Detected license plate image.

3. Experimental analysis and results

The experiments were carried out using 3081 captured images with 640x240 pixels from a cataloged image database, presented in details in [6]. This database is classified in categories and has the information of the position plate for each image.

We performed two experiments to evaluate the proposed method. In the first of them the main goal was to calculate the best set of parameters for these classes of images, since the method can be applied for other classes of images containing characters. This calculation was done iteratively in *CBPF SSolar Beowulf Linux Cluster*. The second experiment was consisted in executing the method with these calculated parameters for the cataloged images of the image database.

The categories of license plate in the image database were: good, knead, unreadable, bent, shadow and license plate color (red or normal). Table 1 shows the results of the second experiment. One can observe the location rates efficiency of the method for different classes of images. Therefore we can use this method to detect the right region of the plate in the image.

4. Conclusion

In this paper we presented a robust method for detection of Brazilian license plate region. A large image database with several kinds of plates was used to evaluate the method. The efficiency of the method was confirmed by the experiment for “good, unreadable, bent and red-license plate images”. We

can also consider a quite good result for the “knead” category. The low performance obtained for “shadow” category can be explained by the significant change of the standard deviation particularly in the plate region.

Table 1. Experimental Results

Quality/ Plate Type	Total/ Detected	(%)
Good	2867 / 2826	98,57
Knead	142 / 116	81,69
Unreadable*	25 / 25	100
Bent	23 / 23	100
Shadow	24 / 6	25
Red License Plate	649/631	97,23

* Classification for poorly stated or unclear license plate images.

5. References

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