EFFECTIVE NUMBER PLATE RECOGNITION USING HOUGH TRANSFORM & OTSU’S SEGMENTATION

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Abstract: Number Plate Recognition system is used for recognizing the vehicle registration number plate of a running vehicle. The disadvantage of the existing system is the cameras are set at the normal height, so it is impossible to recognize the vehicle number plate of running cars by the system. The objective of the proposed system is recognizing and displaying the contents of a running car independent of the heights of the number registration plate using Hough transform & Otsu’s segmentation. The steps included in this proposed method are inputting the image, calculating the outline of each configuration in an input image, recognizing the outline size of the plate area, the areas in an image other than the plate area are masked, then number plate is localized using morphological operations, histogram manipulation and edge detection techniques. For this purpose, we alter the contrast at possible locations where there might be a license plate, we used a filtering method called “region-based” to smooth and uniform and background areas of an image, also we apply the Sobel operator and morphological filtering to extract the vertical edges and the regions respectively, and finally, we segment the plate region by using some geometrical features. This proposed technique is an efficient and simple algorithm to identify characters, without the usage of large memory space.

Index Terms—Hough Transform, Otsu’s Segmentation, Sobel operators.

I. INTRODUCTION

ANPR is an image processing application that is used to determine the vehicles by tracking their number plate without direct human participation. There are number of applications of ANPR, such as automatic ticketing of vehicles at parking region, automatic toll collection at toll gates, monitoring traffic, vehicle tracking during signal offence, access control in building and parking areas, boundary control, car theft detection and in many other application with huge saving of human effort and cost. Another name for ANPR is plate tracking, vehicle number plate recognition, car plate recognition, automatic vehicle identification, license plate recognition etc. All the countries, the attributes of the number plate are strictly maintained. Aspect ratio is used to standardize the vehicle registration number plates. In most of the countries the aspect ratio of all vehicles registration number plate is same. It is calculated by Aspect Ratio=width/height. The extraction of Indian number plate is difficult compared to the foreign number plate. In India there is no standard for Indian registration number plate. This makes the localization and recognition very difficult. Normally there are two types of registration number plates used in India. The number plate has yellow background with back color characters on it for commercial vehicles. And the white background with black character on it for private vehicles. The vehicle registration scheme in India is,

TS 09 MD 7007

This indicates the sample of an Indian vehicle number plate in which TS represent two-letter state code, 09 represent two-digit district code, MD represent series code, and 7007 represent actual registration number that is unique for each vehicle.

II. RELATED WORK

There are so many solutions to relevant problems. The main disadvantage in number plate determination is climate conditions, environmental activity and quality of number plate localization. One basic method is recognizing the number plate is utilizing the coloring characteristics and probability
distribution of the license plate between the two lights. Another famous method of number plate recognition algorithm is template matching [2]. The License Plate Detection algorithm based on template matching was designed and written for managing the parking mass system by identifying the unregistered cars from off campus. Also vertical edges-based automobile license plate detection [6] is popular, too. However, others decide to find the location number plate using horizontal and vertical projections of image [9]. The Genetic Algorithm [4] and Hough transform [8] can be applied to detect the license plate area. At the mean time, the combination of edge statistics and mathematical morphology showed good results [3], [5] and they use block based algorithm. Another rule [11] which concentrates on rows’ distances counts the existent edges and if this number is more than the threshold value then the number plate is recognized. Wavelet transform-based algorithm extract the important features used for number plate localization. The advantages of this algorithm, is to find more than one number plates in the frame. The above methods are very complex and require too much computation time, which is very difficult to use in real time applications. However, other approaches could be used only in specific countries with specific characteristics of number plate like background color, etc.

III. PROPOSED METHOD

The objective of the proposed system is to recognizing and displaying the contents of the number plate of a running car without depending on the height of the number plate. The overall steps included in the proposed method is inputting the captured image, calculating the outline of each configuration in an image, recognizing the outline size of the plate area, using morphological function recognizing and displaying the number on the number plate. The operation of this proposed method is explained in figure 3.1.
Figure 3.1 Number Plate Recognition Systems

The working procedure of this system is, first the video camera takes the photograph of a body of a running car in which the number plate is attached. Figure 3.2

![Figure 3.2 Input Image](image)

This input image is given as a digital data to the system. Smoothing and sharpening are performed to clarify the input digital image. In this stage the noises are reduced and for edge sharpening we used median filter. Differential operation is performed on both vertical (Figure 3.3) and horizontal directions are performed with respect to each pixel in an image.

![Figure 3.3 Vertical Edge Detection using Sobel Operator](image)

The sum of both differential values is calculated. After that the image is binarized (Figure 3.4) with the optimal threshold value calculated by a discriminating analysis method.

![Figure 3.4 Binarized Image](image)

In discriminating analysis first based on the density of the pixels the variances are calculated, second the variance is defined for the total pixel is calculated. Then the threshold is selected, so that the ratio between the variance within the class and variance between the classes are maximal. Swelling and shrinking is performed to modify the roughness on the outlines. So to get a effective result we repeated this process three times. Now the configurations are classified into groups and different numbers are given to each configurations based on the densities. This is called as labeling. Plate localization is to detect the plate size. In general number plates are rectangular in shape. Hence we have to detect the edges of the rectangular plate[11]. After labeling the configurations, the regions will be extracted from the input image.

Using the luminance obtained from the previous step, Otsu’s segmentation is performed. Otsu’s threshold method of segmentation uses the optimization function in such a way that it minimizes the weighted within-class variance or maximizes the between-class variance for different threshold values, t. It is given by the equation:

\[
\sigma^2 = a^2_w(t) + q_1(t)[1 - q_1(t)][\mu_1(t) - \mu_2(t)]^2
\]
After Otsu’s segmentation, apply erosion and dilation separately. Subtract eroded image from dilated image. Apply convolution on the subtracted image, to make the license plate character more visible.

![Morphological Dilation Operations](image)

**Figure 3.5 Morphological Dilation Operations**

In this paper we propose the morphological opening and closing operations to detect the plate area. It is mainly used to remove unwanted objects in the image. i.e.) the dilation operation (Figure 3.5) is used and after this holes are filled by using MATLAB toolbox imfill function (Figure 3.6).

![Image after filling holes](image)

**Figure 3.6 Image after filling holes**

In Character identification the extracted character will be identified by using the Hough transform technique. The character identification (Figure 3.7) will be in the form of an array.

![Number Plate](image)

**Figure 3.7 Number Plate**

**IV. CONCLUSION & FUTURE WORK**

In this method we have extracted registration number plate from image of vehicle. Our proposed extraction process is tested over more than fifty number plates of vehicles under different camera heights and weather conditions i.e. daytime, night time, rainy days, cloudy, sunny also achieved a good success rate.

Although vehicle number registration plate localization and recognition by Hough transform & Otsu’s segmentation system was reasonably successful, still some aspects of the task can be improved i.e. the Hough transform method was not applicable for the different sizes of characters and the registration plates with different tilt angles. Therefore, these variations were considered in the improvement of the task methodology where the characters were resized to a standard formatting and fitted in a standard borderline before the
determination activity. Also to improve the registration plate recognition we have to apply better recognition method such as neural network for character recognition.

V. REFERENCES


