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Automatic Characters Recognition from a Vehicle Number Plate

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ABSTRACT

The vehicle number plate recognition automatically controls access to a secured area for authorized members. We tested our method for number plate recognition which includes five main testimonials first is pre-processing of the input image, then cropping the preprocessed image that follows by the image edge extraction operated on the cropped image after this the character segmentation process algorithm and then finally to the character recognition which gives the improved results that shows our method has the average precision that can be put into practice.

Keywords— ANPR, Number plate, Image edge extraction, Vehicle number plate recognition, Character segmentation

I. INTRODUCTION

The automatic vehicle number plate recognition portray in real-life applications to spot vehicles by encapsulating their number plate. Several works analyze this issue and specify many unfolding to allocate with this work. This increasing passion for the improvement of road safety in various areas like the automatic-toll tax collection, rush hour law enforcement, parking transport access control, road traffic supervision and with the crime prevention. It is executed with the synthesis of five main procedure flow one after other in vehicle number plate recognition method that are the pre-processing of the query image, cropping the pre-processed image then the edge extraction applied on the cropped image that follows the character segmentation and finally, the character recognition. Among this, Segmentation is the most important part in the method because it affect the system accuracy.

Vehicle number plate recognition mainly consists of the five main testimonials. All the steps have their own importance and methods followed in the number plate recognition. In the first stage, pre-processing which reduces the noise of the image and make it more clearly visible. Next step will crop the image and then, the number plate edge extraction is performed. This can be done using many simple methods; it extracts the features of the number plate as well as their shape and symmetry. Then it will segment the characters individually to recognise each character of the number plate using algorithm which also gives the match degree results of the each characters of the number plate.

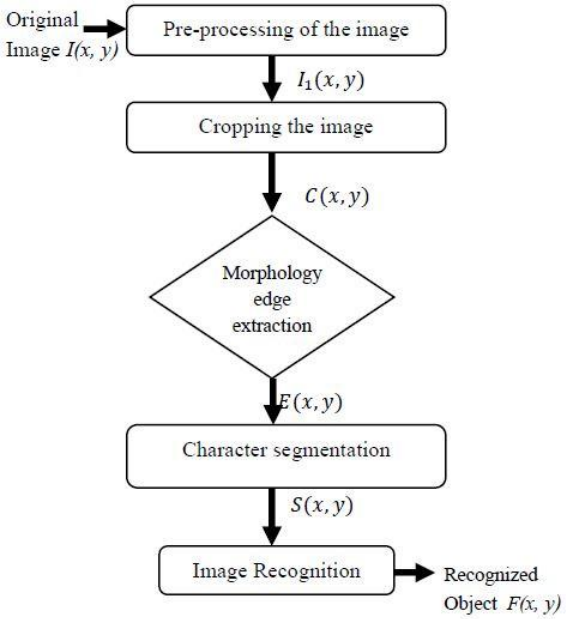

Fig 1:Flow chart

II. PRE-PROCESSING

The pre-processing of the number plate recognition is the first step to remove the useless information from the input image $I(x, y)$. The noise of the image should be removed and the useful information should be acquired by enhancing visual appearance of the image. When the useless information is cleared then the grey scale contrast enhancement improves the appearance by brightening the dataset and the resultant image is $I_1(x,y)$.

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(a)

(b)

Fig. 2 Original input vehicle number plate (a) plate1.jpg, (b) plate2.jpg

III. CROPPING

Next, precisely containing the useful information from the $I_1(x,y)$ then by using the binary coordinates to crop the vehicle number plate which is only required for further processes that results in the $C(x, y)$ image. At this stage, the characters and numbers that were cropped from the query number plate may also contain garbage objects as well as useful objects.

(a)

(b)

Fig. 3 Cropped images of the vehicle number plates (a) plate1.jpg cropped image, (b) plate2.jpg cropped image

This can be obtain by simply cropping the query image only to the extend where the characters and the numbers are visible to eliminate the unwanted region of the query image.

IV. THE EDGE EXTRACTION USING MORPHOLOGICAL OPERATIONS

First, the cropped image $C(x, y)$ should be converted to the binary image consists of only 1's and 0's (for black and white). The edge of the image which is directly extracted by the morphological basic operations gives the $E(x, y)$ from the cropped image $C(x, y)$.

This is performed by using two basic morphological operations that are dilation and erosion.

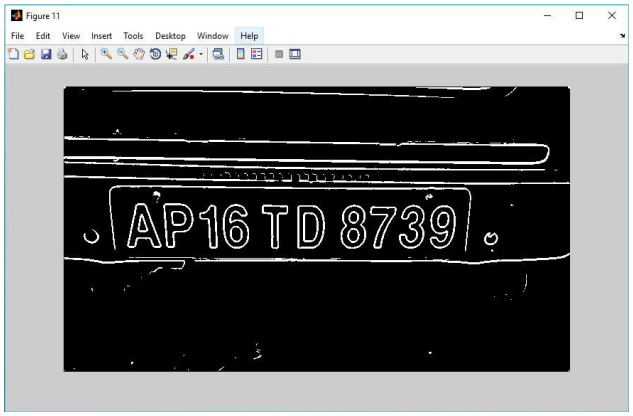


Fig. 4 Morphological edge detection applied on plate1.jpg Binarized images, Morphological edge detection images, and Dilated images using morphologic operation.

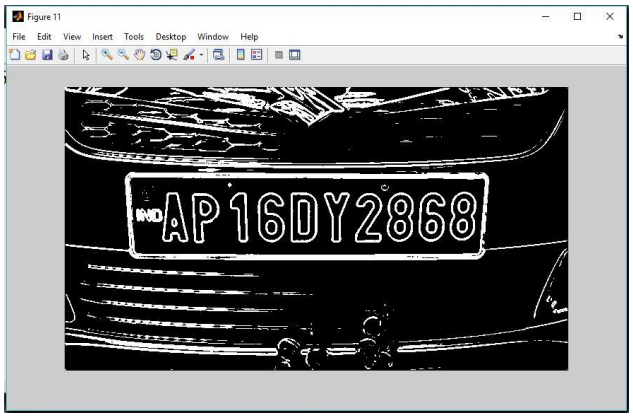
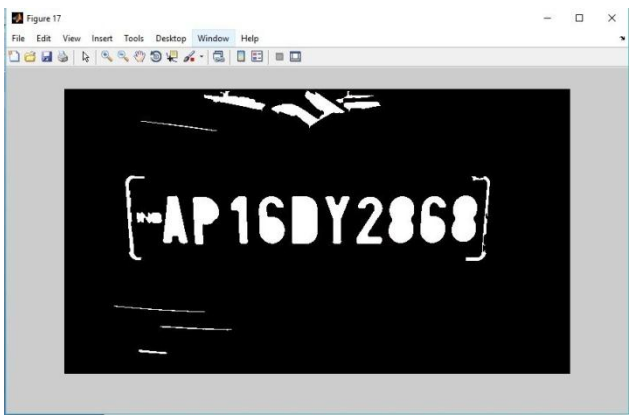


Fig. 5 Morphological edge detection applied on the plate2.jpg. Binarized images, Morphological edge detection images, and Dilated images using morphologic operation.

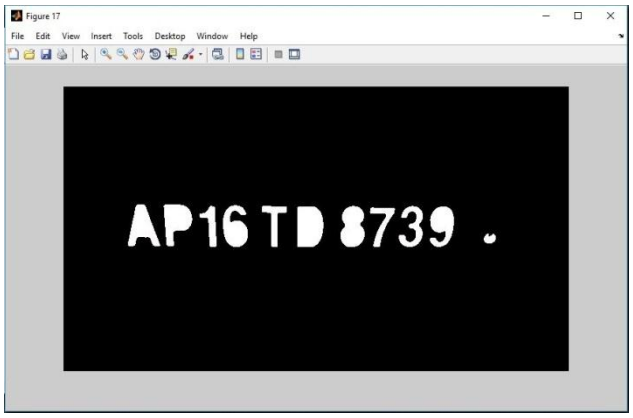
These two methods are based on the fundamental morphological operations by giving the limits 1.1 and the image terminals by selecting different size and extensions converted to images of grey levels and then remove the entire unwanted region. This process, first gives the number of pixels connected together in a sequence to form a group of connected objects. Then, it counts the cropped characters and number of the connected region from number plate and matches this characters and number from the dataset of the template library which is created to call the objects.

V. THE CHARACTER SEGMENTATION AND RECOGNITION

After the edges of the number plates are determined as *E(x, y),* the character segmentation is the next process in the identification module. Each character of the cropped number plate need to be split and the acquired image is the resultant image *S(x, y).* The character recognition algorithms are many but the recent algorithm proposed is Otsu's algorithm. This algorithm identifies separate objects within the image. It finds, that the region of the connected pixels with similar properties and also finds the boundaries between the regions.



(a)



(b)

Fig. 6 Segmented number plates characters (a) plate1.jpg, (b) plate2.jpg

Character Recognition

The final recognition stage is performed by the correlation matching algorithm implementation and the accuracy rate is the approximation of value 1 in the *F(x, y)* image. This final resultant recognized objects of the vehicle implements correlation for the pattern recognition by the following steps:

i. it sequentially multiplies every segmented objects *S(x, y)* over the entire reference image set from the template library,

ii. after this, it calculates the correlation plane for each multiplication,

iii. it identifies the maximum peak value as *max(out)* to the correlation for each segmented character *S(x, y),*

iv. it sorts the maximum peak correlation values from each correlation plane to found the reference image brings about the highest correlation peak value, i.e., with the reference image *S(x, y)* have the best match with unknown input image *I(x, y).*

VI. RESULTS

The correlation matching algorithm gives the absolute values of the match degree of the characters for the two query images namely plate1.jpg and plate2.jpg taken from the matlab library of 512*512 sizes. The results were tested and validated using correlation coefficient (CC) metrics [12]. CC is used to match the characters from the template library and the vehicle number plate.

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2 \sum_{i=1}^{n}(y_i-\bar{y})^2}} \qquad (1)$$

The value of CC lies between 0 and 1 where as the value increases towards 1 will be the best correlation value. The CC value calculated for the proposed algorithm for the recognized image gives the results as Table 1 shown below. This gives the approximation, as the true result according to all the causes of the image kept in mind as through the illumination factor as well as the environmental factors of the plate.

Fig.7-Output on Note pad

Fig. 8-Output on notepad

VII. CONCLUSION

This paper presents a combination of both theoretic practise and the visual results on the vehicle number plate recognition through the hybridization of the morphological edge detection and proposed Otsu's algorithm for the segmentation. The approximate results show that this approach gives the potential of the morphological edge detection and segmentation for vehicle number plate classification that has been assessed. This method have better theoretical properties than the traditional filters that represent images but still not used for vehicle verification. The five main modules that worked together one after one for the improved results even lead to the satisfaction to the natural moving vehicle number plates. The purpose to apply this five testimonial approach is that to eliminate the unwanted region from the vehicle number plate and detect the prominent edges which are required for the recognition of the characters and numbers from the vehicle number plates. Hence, the recognition accuracy is high. The method is quite simple that can be put into practise and also has a good application prospect.

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