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Automatic Indian Number Plate Recognition System

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ABSTRACT
An Automatic Indian Number plate recognition system is one kind of an intelligent transport system and has great importance because of its potential applications in highway electronic toll collection and traffic monitoring systems. It is shown that the number plates are different shape and size and also have different color in different countries. In India the most common vehicle license plate used yellow or white as background and black used as foreground color. This paper presents an approach based on simple and efficient morphological operation and template matching method. The proposed model consists of four main parts pre-processing of image, localization of license plate, character segmentation and character recognition. In this paper, our main focus is on license plate detection and character recognition.The project develops by using MATLAB R2013a.
Keyword: Morphologicaloperation, Template matching, License plate localization, Character recognition.

1. Introduction

Automatic Indian Number Plate Recognition (AINPR) system is an important technique, used in Intelligent Transportation System. AINPR is an advanced machine vision technology used to identify vehicles by their license plates without direct human intervention. There are many applications for license plate recognition for example Automated parking attendant, Petrol station forecourt surveillance, Speed enforcement, Security, Customer identification enabling personalized service, highway electronic toll collection and traffic monitoring systems.

It is shown that the license plates are different shape and size and also have different color in different countries. In India the most common license plate color used for commercial vehicle is yellow and private cars is white as background and black used as foreground color. Though in Indian there is standard format for license plate, as described in figure 1.1, which is not followed which makes the License plate recognition system quite difficult. The Indian license plate start with two digit letter "state code" followed by two digit numeral followed by single letter after those four consecutive digits as the described below in figure1.

Figure1: Standard Indian License Plate format

From the figure 1, 1 indicates the Country code, 2 indicate the state code, and 3 indicate the district code, 4 indicate the type of vehicle and 5 indicates the actual registration number. The identification task is challenging because of the nature of the light. The location error will increase if the color of the number plate is very similar to the background. Noise on the number plates some time cause of error and low accuracy. There are some limitation that led to failure in most practical application due to the diversity of the number plate characteristics and the complexity of the natural environment like rain, snow, dust for etc. So, a flexible algorithm required for solved this task.

In this paper will explore and elaborate the proposed algorithm for AINPR for Indian license plate. AINPR process consists of four stages: 1) Preprocessing 2) License plates localization 3) Character segmentation and 4) Character recognition. In first stage, acquired image is enhanced by converting RGB image to gray image, thresolding, median filtering etc. In the second stage, license plate localization which is difficult but most important stage is obtained, based on the several features of license plates. Features commonly employed have been derived from the license plate format. The features regarding license plate format include shape, symmetry, height-to width ratio, area in comparison to image size. In third stage, characters are segmented using bounding box analysis. Fourth stage, character recognition is achieved using template matching analysis.

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2. Proposed system

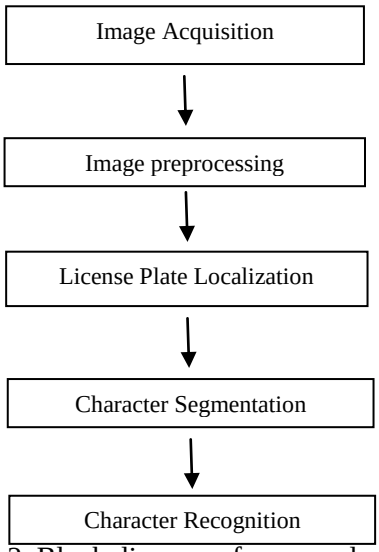

Figure2. Block diagram of proposed system

The block diagram of Automatic Indian Number Plate Recognition is as shown in fig. 2.There are various steps in this approach and these are implementation in MATLAB R2013a.

2.1 Image Acquisition

The first stage of any vision system is the image acquisition. The image is taken from low resolution camera or from database as per the application. Figure3. Shows the acquired image of car below which is consider as original or raw image of car.

Figure3. Original image

2.2 Image Preprocessing

When an image is acquired, there may be noises, low contrast, unwanted object etc present in an image. These noises affect the recognition rate greatly. So, these unwanted noises should be removed from the images. To get enhanced image the original image preprocessing with various operation and these are described below.

2.2.1 Gray scale conversion

It involves conversion of RGB image into a gray scale image. It is more convenient and easier to deal with one component (intensity) in gray scale images thanthree color components (red, green, blue) in color images

$$G(x,y) = 0.3R+0.59G+0.11B$$

Figure4. below shows conversion of RGB image into Gray scale image, noise reduction and contrast enhanced image . The method is based on different color transform. According to the RGB value, gray value is obtained.

2.2.2 Noise reduction

We used median filtering technique to reduce the paper and salt noise. We have used 3x 3 masks to get eight neighbors of a pixel and their corresponding gray value. If f(x, y) represents the dealt image and g(x,y) represents the result image, noise removal using median filtering is shown as:

$$g(x,y)=f(x,y)*h(x,y)$$

Where h(x, y) is filter transfer

Noise removal is necessary step for Number plate recognition because it greatly affects the recognition rate of the system.

2.2.3 Contrast enhancement

Using histogram equalization technique the contrast of each image is being enhanced. The function used to enhancement that is I_Adst = imadjust(I_Gray,[0.3 0.7],[]). The pixel with value below 0.3 is 0 and value above 0.7 is 1 and in between is kept same.

Figure4. Grayscale, noise reduced & contrast enhanced image

2.3 Number plate localization

The plate localization is the most important phase of the license plate recognition system. Number plate localization consists of number of step. We will each step in detail. License plate region are consider based on the features of license plates.

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2.3.1 Opening and closing of image

Opening is nothing but erosion followed by dilation and closing is inverse. Opening of image is processes of adding pixel to boundary & closing is removing of pixel from boundary. Firstly, enhanced image is opened and closed using imopen and imclose function respectively. Figure5.(a) Shows opening image & (b) closing image. Once we get this two image take different of them. We get difference result as show in figure6. Which consist of license plate region as highlighting.

(a) (b)

Figure5.(a) Opening & (b) Closing of gray scale image

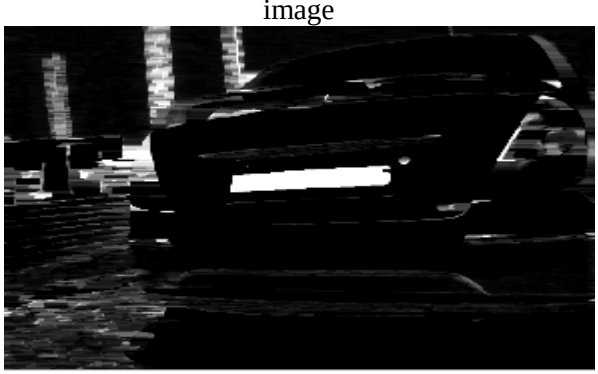

Figure6. Difference of opening and closing image

2.3.2 Image binarization

Binarization is a process in which image pixels are distinguished into two kinds of color (black & white) according to certain criteria. A threshold level is select for binarization. Figure7. Show a binary image.

Figure7. Binarized image

2.3.3 Elimination of unwanted region

The binary image show in figure7. Consist of many unwanted region. This unwanted is eliminated in following way and thus produce another binary image.

1. Determine the connected components.
   [L num]=bwlabel(bw);
2. Compute the area of each component.
   STATS=regionprops(L,'area');
3. Remove small objects on the base of area

```
idx = find([STATS.Area] > 500);
bw2 = ismember(L, idx);
```

Figure8. Binary image with unwanted region eliminated.

2.3.4 Mapping of candidate region

After unwanted region is eliminated a bounding box is obtained from the binary image and mapped on original image. In following way dimension for mapping we get:

```
Iprops = regionprops(Ilabel);
Ibox = [Iprops.BoundingBox];
```

Bounding box is dimension of rectangle box created around the connected object within an image figure 9. Shows a bounding box mapped image.

Figure9. Mapped candidate region

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2.3.5 Number Plate Extraction

The mapped candidate region are check for certain parameter if all the parameter are satisfied the candidate region is consider as number plate and is segmented from whole image . The parameter of license plate includes shape, symmetry, height-to width ratio, area and number of connected component. Figure10. show Number plate which extracted is from the whole image and binarized.

Figure10. Extracted Number Plate

2.4 Character Segmentation

Character segmentation is necessary step for recognition of character. Again the unwanted object like dots or some noise needs to be removed. After removing the unwanted object we get the license plate as shown in figure11.

Figure12. License plate free of unwanted object

After removing unwanted objects dilation is performed. Dilation is adding of pixel to boundary of an object. The need for dilation is, in case of broken or disjoints character. As we will use connected component analysis for segmentation character may be treated as other connected character. Once the character is dilated connected component analysis is done and bounding box is obtained from the dilated image. And this bounding box is mapped on the license plate free of unwanted object. Figure13. Show mapping of character in license plate. Mapped character are cropped and bordered by black pixel. Figure14. Show segmented character.

Figure13. Mapped Character

Figure14. Segmented Character

2.4 Character Recognition

The final step of the Number Plate Recognition System is character recognition. Character recognition technique for are template matching, neural network, etc. As in Indian license plate character vary in there font, size etc. character need to be skeleton, so that they look more similar. Figure15. Shows the skeleton of each segmented character.

Figure15. Skeleton of segmented character

Fitting approach is necessary for template matching. For matching the characters with the database, input images must be equal-sized with the database characters. Here the characters are fit to 24x42. The extracted characters segmented from plate and the characters on database are now equal-sized. The next step is template matching. Template matching is an effective algorithm for recognition of characters. The character image is compared with the ones in the database using correlation and the best similarity is measured. GUI model is as show in figure16.

Figure16. GUI model for Number Plate Recognition System

3. Experimental result

We have run our proposed method on desktop computer with Core2 duo processor 2.10 MHz with 2 GB of RAM under MATLAB R2013a environment. Several vehicle images are captured using 1.3 mega pixel camera. In the experiments, we test our proposed method on the different type car image to identify the Number plate location and character recognition.

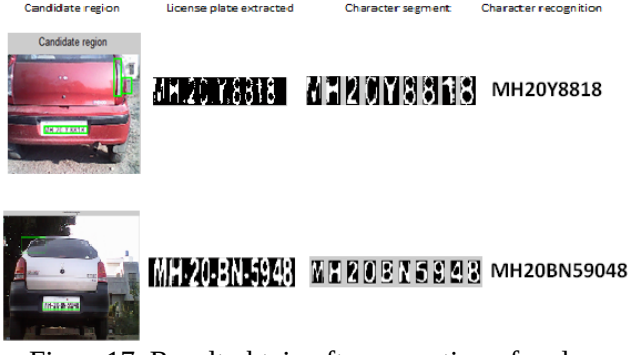

Figure17. Result obtain after execution of code

4. Conclusion & future work

In this paper, an efficient less time consuming vehicle number plate detection method is proposed which performed on complex image. The system has been tested also on images of various lighting conditions & system can be implemented on motorways & highways for automatic toll tax collection. The proposed system works quite well however, there are still areas for improvement.

References

[1] Rafael C. Gonzalez and Richard E. Woods, *"Digital Image Processing"3rd edition*, Pearson/Prentice Hall, 2008 (variance) pp. 96 97,(MathematicalMorphology) pp. 628-635, (Segmentation) pp.700-725, (Thresholding) pp.738-742, (Object Recognition - Correlation) pp. 866-872.

[2] X. Fan and G. Fan, "*Graphical models for joint segmentation and recognition of license plate characters*," IEEE Signal Process. Lett.,vol. 16, no. 1, pp. 10–13, Jan. 2009

[3] Zhigang Xu, Honglei Zhu, "An Efficient Method of Locating Vehicle Licence Plate", 3rd International conference on Natural Computetion, IEEE, 0-7695-2875-9/07, 2007.

[4] Yo-Ping Huang, Shi-Yong Lai,Wei-Po Chuang, *"A Template-*

Based Model for License Plate Recognition", IEEE International Conference on Networking, Sensing & Control,

March 21-23, 2004.