IMPLEMENTATION OF LICENSE PLATE SEGMENTATION AND RECOGNITION

Wahyu Rahmaniar

Intelligent Control and Image Processing lab,
Department of Electrical Engineering,
National Central University

ABSTRACT

In this paper we present a vehicle license plate segmentation and recognition system. Using a manual input image, we change the image into black and white color and crop the image based on the white pixel border of the license plate character.

After cropping image, we segmented each character in the image based on the minimum border as the leftmost white pixel of the first character and the maximum border as the black vertical line beside every character.

We separated every character in the image then resize it into 10x15 pixels and recognize the character using database that contain of 108 characters of numbers and alphabets.

Index Terms— license plate, segmentation, recognition.

1. INTRODUCTION

Automatic License Plate Recognition System is one of the hot core issues of intelligent traffic management. It extracted the license plate information to facilitate traffic control, management fees and statistics by using computer to process, analyze and recognize the video traffic images. Many scholars at home and abroad are specializing in license plate localization and character recognition technologies, and have achieved many results [1], but there is still much to continue to study and improve.

License plate recognition technology mainly consists of three links which are license plate localization, character segmentation and character recognition, and these three links are carried out in turn. This paper is hammering at the technologies of the character segmentation and character recognition respectively, and then a license plate recognition method was presented using programming that carried out in Visual Studio.

The experimental result shows that the method has a good segmentation and recognition of the license number.

2. RELATED WORKS

Automatic License Plate Recognition System is still in its infantry. The plate region extraction is the most challenging part of the entire system and only a few methods have been proposed for it. One such method includes the use of Hough transform [2]. Candidate rectangular regions are obtained by detecting horizontal and vertical lines (as the license plates are rectangular). From these candidate regions, the most suitable rectangular region is chosen using prior knowledge.

Another method found the location of the license plate in the image [3]. The license plate region, which has its own characteristic frequency response, is filtered out from the rest of the image.

In this paper we use method as shown in Figure 1.

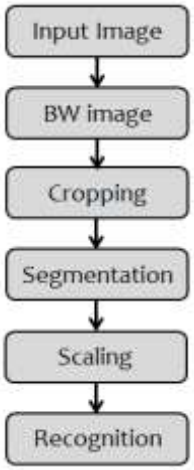

Figure 1. Block Diagram of Automatic License Plate Recognition System

3. PRE-PROCESSING IMAGE

Before implemented the main part of this paper, make the image suitable to use in the whole process of the method. In order to simplify the segmentation method change the input

image into black and white color, and crop it based on the outer white pixel border.

3.1 Binarization

In the process of binarization, the threshold of pixel value more than 128 to change the pixel into white color value or 255, and otherwise the pixel change into black color or 0, as shown in Figure 2.

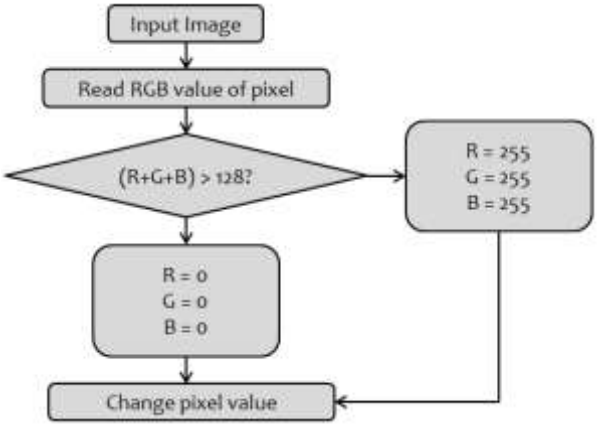

Figure 2. Binarization Flowchart

a) Input Image

a) Black and white image

Figure 3. Result of Binarization Image

3.2 Image Cropping

First, the image crop manually with subtraction of the width image 60 pixel in every side and 40 pixel of the height image in every side, as shown in Figure 4.

a) Image before cropping

b) Image after cropping

Figure 4. Result of First Cropping

Second, find the leftmost and rightmost of white pixel to determine the border of width image, and find the upper and lower of white pixel to determine the border of height image, the result as shown in Figure 5.

Figure 5. Result of Second Cropping

4. SEGMENTATION

Segmentation is used to separate every character in the plate license image based on the white pixel as the border of every character. As the result of image cropping, we got the leftmost pixel in the image is white value, then find the black vertical line or one column of black pixel value and mark it as the maximum width of one character. Then crop the character based on the minimum border (leftmost white pixel) and maximum border (black vertical line).

As the result of crop one character, the leftmost pixel value in the image is not white or there is space before the first character. Then, crop image based on the leftmost white pixel value to place the first character in the border image. Figure 6 show the algorithm of the character segmentation.

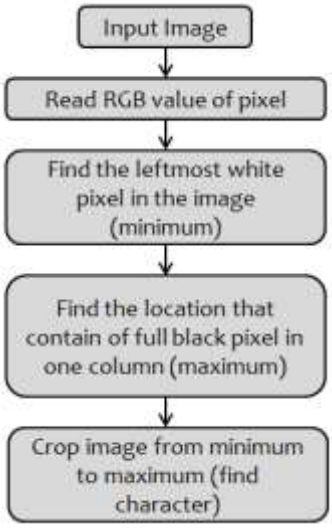

Figure 6. Character Segmentation Flowchart

a) One Character Segmented

b) Image after one character cropped (there are some space of black pixel before the first character)

c) Crop image based on the leftmost white pixel value (the first character in the border image)

Figure 7. Character Segmentation Result

4.1 Some Problems in Segmentation

Sometimes the result of cropping image after segmentation is not correct as shown in Figure 8.

a) Expected Cropping Result

b) Error Cropping Result

c) A little white pixel disturbed segmentation

Figure 8. Some Problems of Cropping Image after Segmentation

Figure 8 is the error result of cropping image after segmented a character and will disturbed the result of the next character segmentation as shown in Figure 9.

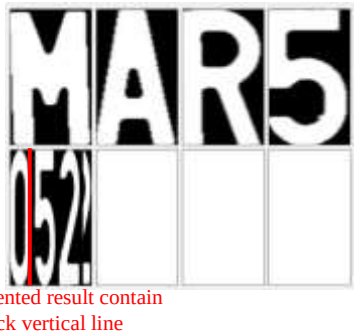

Figure 9. Error Result of Segmentation

To avoid the error of segmentation result, we need to check every character that already segmented. If the character image contain of black vertical line it means the segmentation is failed, then we need to crop the main image again and make sure that the leftmost pixel in the border is white pixel from the leftmost character and replace the failed result with the new one.

Figure 10. The Successful Result of Segmentation

5. CHARACTER RECOGNIZATION

After we get the segmentation of every character in the license plate image, we need to scale of every result into 10x15 size pixels to make the recognition faster.

In order to make database easier, invert the color of character image (black to be white and white to be black) as shown in Figure 11. We make the database of character of number 0-9 and alphabet A-Z from some license plate image and save it with the size of 10x15 pixels as shown in Figure 12.

Figure 11. Resize and Invert Character

Figure 12. Database of Number and Alphabet

Then, we find the similar image of every character segmentation result with the database.

6. EXPERIMENT RESULT

We use input image of some license plate that we found from the internet and got successful result as shown in Figure 13.

Figure 13. Successful Result of Segmentation and Recognition License Plate Character

Sometimes we also got the error result as shown in Figure 14. Because one or more characters are not cropping correctly and got error result of recognition, the character is unrecognized.

Figure 14. Unsuccessful Recognition

7. CONCLUSIONS

The system performs well on various types of license plate images. In addition, it can deal with the different types of vehicles such as motorbike plates, car plates or truck plates. However, it still has a few errors when dealing with bad quality plates.

11. REFERENCES

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