

Vehicle Number Plate Recognition System

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Abstract - In this paper, study for automatic vehicle number plate identification is explained. Automatic Vehicle Number Plate Recognition system is a system which is use to help to identify the vehicles through their number plates by capturing the image of vehicles and recognizes their license number. The camera focused on the number platemand processed it by using various algorithms. The recognition can be done in three steps: Localization of the plate, extraction of the plate characters, and recognition of the characters using a suitable identification method. Our study focusing on the two algorithms i.e., Edge Finding Method and Window Filtering Method for the number plate detection system. Then at the last character recognition is done by Probabilistic Neural Networks(PNN). The PNN is used to identify alphanumeric characters from car license plates based on data obtained from image processing.

Key Words: Image acquisition, Widow Filtering, Edge Finding, Binarization and noise removal, optimal character recognition(OCR),.

1. INTRODUCTION

As security awareness in every stream is increases the need for vehicle security has raised the authentication technologies .Proposed system may be a control system for monitoring of unauthorized vehicles entering private areas.

It can be used for many purposes like electronic payment systems (toll payment, parking fee payment), freeway and arterial management systems for traffic surveillance.

2. IMAGE ACQUISITION

Image acquisition is the process of obtaining an image from the camera. This is the first step of any vision based systems. In our System we acquire the images using a digital camera placed by the road side facing towards the incoming vehicles. The other part of the system works in offline mode. After acquiring the image, the next step is to derive the gray scale image. Pseudo code to convert an image to a grayscale:

STEP1 : Load the image

STEP2 : Retrieve the properties of image like width, height and nchannels

STEP3: Get the pointer to access image data.

STEP4: For each height and width of the image, convert image to grayscale by calculating average of r,g,b channels of the image and convert it to grayscale manually.

STEP5 : Display the image after converting to grayscale.

3. IMAGE PROCESSING

It consists the following major stages: 1. Binarization, 2.Noise Removal

□ **Binarization:** The input image is initially processed to improve its quality and prepare it to next stages of the system. First, the system will convert RGB images to gray-level images.

□ **Noise Removal:** In this noise removal stage we are going to remove the noise of the image i.e., while preserving the sharpness of the image. After the successful Localization of the Number Plate, we go on with Optical Character Recognition which involves the Segmentation, Feature extraction and Number plate Recognition.

4. EDGE FINDING

First, the original car image in color is converted to black and white image grayscale image. The original image is converted to grayscale image which is in high contrast. Then

identification of the location of the number plate has done. The letters and numbers are placed in the same row. The Horizontal intensity graph is as follows, with the peaks indicating high contrast regions in the image:



Fig1:Sum of Filtered Rows

The algorithm first determines the extent of intensity of variation for each row, while in the second step it selects the adjacent rows which exhibit the biggest changes. The variations are the highest at the letters; therefore this is where the rate of change within a row is expected to be the highest. The vertical position of the number plate will be found in the second step by using a picture obtained by band pass filtering. By summing up the results of filtering for each row the vertical position of the number plate is determined on the basis of the statistics property of the individual rows.

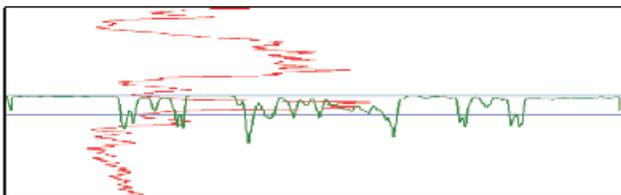


Fig2: Sum of Columns

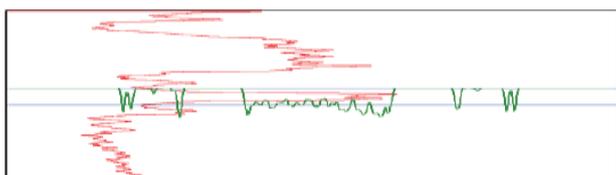


Figure 3: Sum of columns after horizontal and vertical filtering

Two procedures are applied: Analysis of the boundary ratios and the extent of the areas. Investigation of the boundary ratios depends on the fact that the ratio of the horizontal and vertical sizes of a number plate falls in a predefined interval. If the found number plate does not fulfill the criteria, the search process will be continued in another place. In the case of area evaluation, those regions are eliminated that are too small or are too big to process, even if they fulfill the boundary ratio requirement. If still more possible areas remain, the one featuring the highest

specific brightness is selected because number plates contain a lot of sharp changes.



Figure 4: Number plate identified by simple edge search.

5.Window Filtering:

The original image with complex background is Filtered and the filtered image shows the High contrast regions apart from the number plate. The surroundings are unnecessarily included in the image. We need to consider a window to exclude the unnecessary surroundings from the image and concentrate on the actual image. The window size is estimated on the basis of the expected size of the number plate. If the window is chosen to be as wide as the image, then the previously introduced algorithm is obtained, while too small window size leads to incorrect results. The best result is obtained if the window size equals to the width of the number plate, but smaller window dimensions provide good values too. After determining the appropriate window size, we perform the sum of filtered rows and columns. Finally, after the window filtering technique, we remove the unnecessary complex parts of the image and get the required number plate localized. The final number plate acquired by the window filtering technique is shown below



Figure 6 : Number plate localized by window method.

6. ALGORITHM OF PLATE PROCESSING & CHARACTER RECOGNITION

The image is transformed to a standard size of 75x228 pixels using the bicubic interpolation method and then subjected to the SCW segmentation method with the following parameters: $X1=2$, $Y1=5$, $X2=4$, $Y2=10$, $T=0.7$ where the measurement is the standard deviation value. In the specific task the objects to be emphasized (the characters) have an aspect ratio (height/width) near to 5/2. Therefore, the parameters for the inner window was set $X1=2$, $Y1=5$ and for the outer window $X2=4$, $Y2=10$ in order to ensure an aspect ratio of 5/2 for both concentric windows. The threshold T was set to 0.7 after a trial and error for the optimization of the results.

- For $j=1:n$, where n is the number of detected plates
Input: matrix $A(j)$

1. Crop I using the coordinates in matrix A(j)
Name the resulting image I2;
2. Resize I2 to 75x228 pixels using bicubic interpolation;
3. For each pixel in image I2,
Run SCW method in I2;
Parameters: $X1=2, Y1=5, X2=4, Y2=10, T=0.7$ And
 M =standard deviation value; Name the resulting image I3;
4. Inverse image I3
Name the resulting image I4;
5. Retrieve objects which fulfill the following measurements: (Orientation>75 degrees) and (Height>32);
6. The components whose measurements do not fulfill specific are deleted.
7. The remaining objects are then forwarded to PNN after a well defined preparation process, and finally.
8. Forward input vector to PNN and get decision;

7. CHARACTER SEGMENTATION

The Steps in character Segmentation are:

- **Preprocessing:** Our preprocessing consists of conversion to grayscale and binarization using an object enhancement technique. The steps include are: Conversion to Grayscale, Binarization. Compared with the methods of image binarization, this algorithm uses the information of intensity and avoids the abruption and conglutination of characters that are the drawbacks of usual image binarization techniques.
- **Object enhancement algorithm:** The quality of images varies with different capture conditions. Illumination variance and noise make it difficult for character segmentation. Then some image enhancement should be adopted to improve the quality of images. For character segmentation, *only the character pixels need to be enhanced and the background pixels should be weakened at the same time. A license plate image contains about 20% character pixels. So these 20% character pixels need to be enhanced and the rest pixels need to be weakened. It is called object enhancement. The object enhancement algorithm consists of two steps: First, gray level of all pixels is scaled into the range of 0 to 100 and compared with the original range 0 to 255, the character pixels and the background pixels are both weakened. Second, sorting all pixels by gray level in descending order and multiply the gray level of the top 20% pixels by 2.55. Then most characters pixels are enhanced while background pixels keep weakened.*

8. OPTICAL CHARACTER RECOGNITION

OCR is the translation of images of handwritten or typewritten text (usually captured by a scanner) into machine-editable text. The procedure consists of two important steps, training and recognition. Training: The program is first trained with a set of sample images for each of the characters to extract the important features based on which the recognition operation would be performed.

8.1 Creating the template:

In order to create the template for each character we do the following operation. For every white pixel we insert the value 1 and for every black pixel 0.

CONCLUSIONS

This paper presents a vehicle plate recognition method in which the vehicle plate image is obtained by the cameras and the image is processed to get the number plate information. A rear image of a vehicle is captured and processed using various algorithms. Further we are planning to study about various algorithms which is suitable for better performance and advancement.