International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET)

ISSN 2455-4863 (Online) www.ijisset.org *Volume: 2 Issue: 6 | June 2016*

A NOVEL APPROACH FOR CHARACTER RECOGNITION OF VEHICLE NUMBER PLATES USING CLASSIFICATION

Nora Naik

Assistant Professor, Dept. of Computer Engineering,
Agnel Institute of Technology & Design, Goa, India

Mayuri Patgaonkar, Gautami Pangam, Neha Navelkar, Shivani Rivonkar, Sweta Kumari

BE Students, Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India

Abstract: *LPR (License Plate Recognition) is an image-processing technology used to identify vehicles by their license plates. This technology is used in various security and traffic applications. The proposed algorithm focuses on recognizing the characters on the vehicle license plate from images of the front or rear side of the car using classification approach. The focus is on the design of the algorithm used for extracting the license plate from a single image, segmenting the characters on the plate and then identifying the characters based on alpha-numeric classification. The proposed system has been implemented using Java and the experimental results have been shown for recognition of Goa license plates.*

Keywords: *License plate, segmentation, classification*

1. INTRODUCTION

Vehicles in each country have a unique license number written on its license plate, which distinguishes one vehicle from the other. An automated system can be implemented to identify the license plate of a vehicle and extract the characters from the region containing the license plate. This paper aims to recognize the characters on the vehicle license plate from images of the front or rear side of the car using classification approach. The vehicle number on the license plate is written with different fonts and font sizes and hence the focus is on the design of the algorithm used for extracting the license plate from a single image, segmenting the characters on the plate and then identifying the individual characters based on alpha-numeric classification.

2. APPLICATIONS

Law enforcement: To produce a violation fine on speeding vehicles and detection of stolen or wanted vehicles

Parking: To automatically calculate parking fee by comparing the exit and entry time.

Automatic Toll Collection: To automatically classify vehicles in order to calculate the correct tariff.

Border crossing: This application assists the registry of entry or exits to a country, and can be used to monitor the border crossings.

3. PROPOSED SYSTEM

We have considered Goa registered vehicle license plates for our experiment, where the vehicle number is printed on a single row. The approved sample format of Goa registered vehicle license plate is shown in figure 4.

The input to the proposed system are images of the front or rear sides of the car containing the license plate which are stored in a specific folder on the system (computer) and its output is the recognition of characters on the number plate.

The proposed system consists of 5 phases, as shown in the flowchart below:

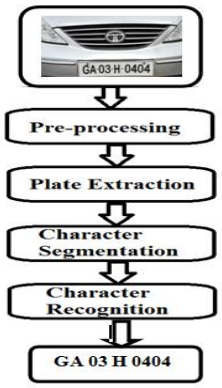

Fig 1: *Proposed System flowchart*

3.1. Image Acquisition (Input Image)

In the proposed system, images are captured using a 13MP digital camera and later resized into 400 x 200 resolution for practical purpose and stored as full

colour JPEGs in a folder. The pictures were all taken in broad daylight, from a standard distance and angle. We did not deal with skew as in a practical setting the camera will be in a fixed location. We captured 50 images under the previously mentioned conditions to be used as our testing set.

3.2. Pre-processing

3.2.1. Convert the coloured image into gray image

The algorithm described here is independent of the type of colours in image and relies mainly on the gray level of an image for processing. So the input image which is a coloured image is converted into a gray image before further processing. Since the image has different colours, the RGB image is converted to gray scale image using NTSC standard method.

$$Gray = R \times 0.299 + G \times 0.587 + B \times 0.114$$

3.2.2. Contrast Enhancement:

To enhance the contrast of the image Histogram Equalization algorithm is used. Histogram equalization is performed by remapping the gray levels of image based on the probability distribution of the input gray levels. It flattens and stretches the dynamic range of the gray image histogram.

$$\mathbf{H\ (v) = round\ \{} \frac{CDF(v) - CDF_{min}}{(M \times N) - CDF_{min}} \times (L-1)$$

CDF: cumulative distribution function,

M, *N*: rows and columns of the image,

L: total number of gray-levels

3.2.3. Noise Reduction:

In the proposed system, median filter is used for the noise reduction. It is the best known order statistics filter, which has its name implies, replaces the value of a pixel by the median of the gray levels in the neighbourhood of the pixel:

$$F(x,y) = median_{(s,t) \in Sxy}\{g(s,t)\}$$

Median filters are particularly effective in the presence of impulse noise (salt and pepper noise).

3.2.4. Image Binarization:

Image binarization is the process of separation of pixel values into two groups, background and foreground or object pixels [1]. In this paper we have implemented Otsu's thresholding method which is the most commonly used method for image binarization using a global threshold. It involves iterating through all the possible threshold values and calculating a measure of spread for the pixel levels that either falls in foreground or background. The aim is to find the optimum threshold value where the sum of foreground and background spreads is at its minimum. Replace all pixels in the input image with luminance greater than a threshold value with the value 1 (white) and all other pixels with the value 0 (black).

Fig 2: *(a) Grayscale image (b) Binary image.*

3.3. License plate Localization and Extraction:

In this paper we have implemented feature based localization using the following steps:

1. In each row we count the number of colour transformations i.e. from black to white or white to black. Store this count in an array.
2. Set the threshold value for the count, since the License plate will have certain number of transformations as it contains 9 to 10 characters written in black on white background.
3. Neighbouring rows that satisfies the above threshold are combined to form a region, and row does not satisfy the threshold condition, it will form a break or end of the region.
4. From all the regions, select the one in the middle of the image or below the half of the image, and whose height is in the range of 10 to 30 pixels.

3.4. Character Segmentation:

Character segmentation refers to the process of locating and separating each character in the image from the background. In this paper we are working on single row License plates.

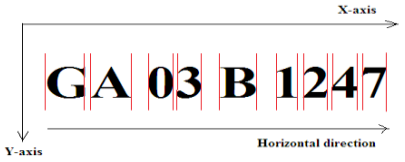

Fig 3: *Shows how to implement the algorithm of character segmentation*

Consider binary image as a matrix. We use the sum function which is to return the row vector of the sums of each column. Next, we should search the matrix along the horizontal direction by a loop. According to the sum, we could create the limited condition to judge whether the loop continues or terminates. The limited condition is when the sum of some column is less than 1 and the sum of next column is greater than 1, then it will be segmented from this column to before. Certainly, if the condition isn't satisfied, it would continue to search.

Later we calculate the distance between the saved indices. If the distance is greater than zero, split the region and save the split regions that contain the character in a different file. All the segmented characters get resized to 20 X 20 before giving them as an input to next step of character recognition.

3.5. Character Recognition:

This section presents the methods that were used to classify and then recognize the individual characters. The classification is based on the extracted features, which are then classified using statistical pattern recognition approach. et. al. [2] adopted a structural or syntactic approach to recognize characters in a text document, this approach is based on the detection of black pixels in the four directions (up, down, left and right), which permits the classification of characters into different classes.

4. Proposed Methodology for character recognition

In the proposed system, we have considered a total of 36 classes (26 alphabets A-Z, 10 numbers 0-9) with 5 different font styles for each class (Algerian, Times New Roman, Tahoma, Baskerville old face & Calibri). Each character in a class is a JPEG image of size 20 X 20. Also, we are dealing with Goan license plates written in a single row. Figure 4 shows a sample of Goa vehicle license plate which contains two alphabets, two digits, one alphabet and followed by 4 digits.

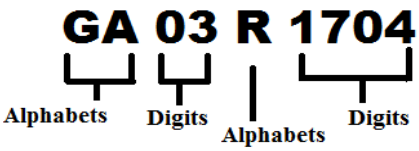

Fig 4: *Goa License plate*

The 1st, 2nd and 5th characters are alphabets and hence we just compare them only with alphabet classes and the rest with number classes.

Steps followed for character recognition are as follows:

Find the mean of all the characters in each class (26 alphabets, 10 numbers) and save this in a folder. Hence we have the mean of 26 alphabet classes and 10 digit classes.

Find the bit map of the segmented characters and also for all the mean characters we had found in step 1.

Compare the bitmap of each segmented character with the bitmap of each mean character classified to find the match. We assign a counter for every character classified and increment the corresponding counter each time the same bit is found at the corresponding bit position while doing the comparison. The character classified which gives the maximum count is the recognized character

Due to the format of the Goan license plate, while doing the comparison in step 3, we compare the first two segmented characters only with the mean of alphabet classes (26 classes). Next, we compare the third and fourth segmented characters only with the mean of number classes (10 classes). Later, we compare the fifth segmented character only with the mean of alphabet class (26 classes). Lastly, we compare the sixth, seventh, eighth and ninth segmented characters only with the mean of alphabet classes (26 classes). This makes the processing much faster.

Some discrepancies occur in the algorithm, where we do not get accurate results. In such special cases, we classify the characters based on their features.

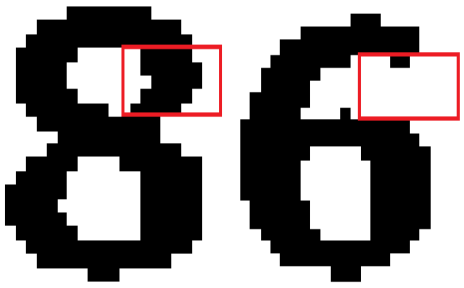

Fig 5: (a), (b) mean images of '8' and '6'

In above figure we see segmented characters 8 & 6 which are differentiated from each other based on the features present in the region marked in red box. The presence and absence of black pixels in the marked region shows the difference between the two characters. The count of black pixel in red region of 8 is more than the count of black pixel in red region of 6 therefore it is classified as 8.

5. Experimental Results

Fig 6: *(a) Browsing of image*

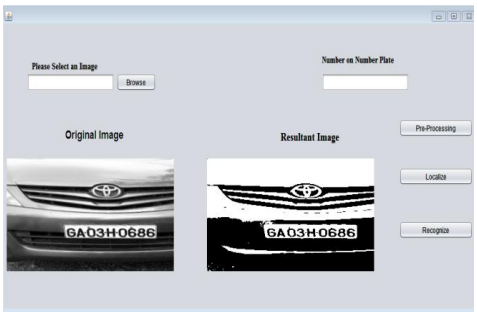

Fig 6: *(b) Pre-processing*

Fig 6: *(c) Locating license plate*

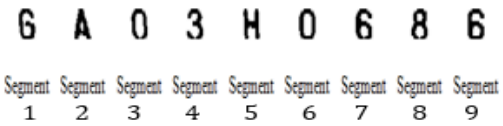

Fig 6: *(d) Segmented characters*

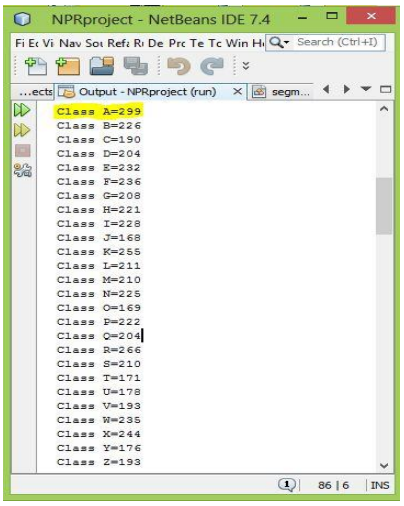

Fig 6: *(e) Pixel count of second character segmented with each alphabet class.*

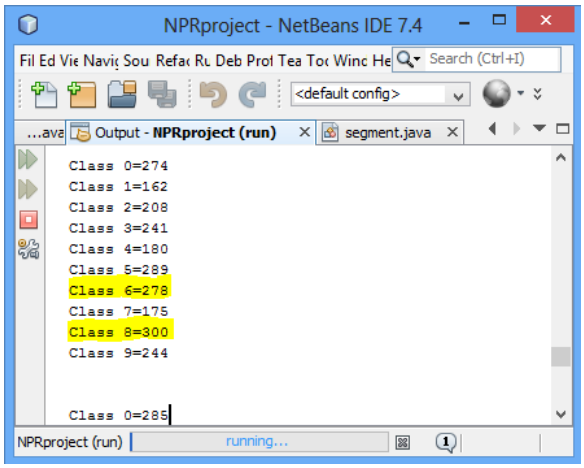

Fig 6: *(f) Pixel count of seventh character segmented with each number class.*

In this case the character segment shows maximum count for 8 instead of 6, so we use the unique features of 6 to classify it (refer fig 5).

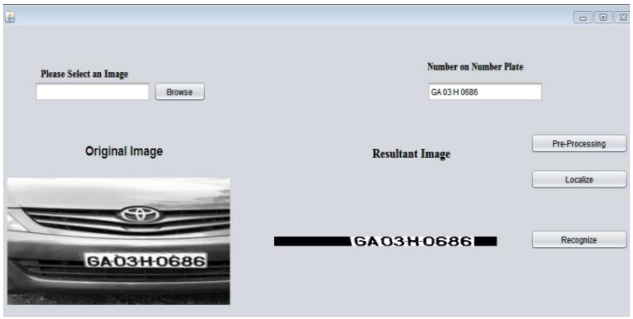

Fig 6: *(f) Recognized license plate*

6. Conclusion

In this paper we have used classification algorithm to recognize the vehicle number from the license plates using classification. The performance evaluation of the system was carried out on license plate images taken under different conditions. The proposed method is tested on 50 different license plate images and the success rate of character recognition reached to 70%.

However the proposed algorithm works only for Goan license plates written in one row, containing 9 to10 characters. In future we can extend this algorithm for license plate written in two rows and any number of characters.

REFERENCES

[1] T. Romen Singh, Sudipta Roy and O. Imocha Singh, "A New Local Adaptive Thresholding Technique in Binarization", Department of Information Technology, School of Technology, Assam University, Silchar – 788011, Assam, India.

[2] Hamami, L., and, Berkani, D., "Recognition System for Printed Multi-Font and Multi-Size Arabic Characters", the Arabian Journal for Science and Engineering, vol. 27, no. IB, pp. 57-72, 2002.
[3] Jun Kong, Y.L., Xinyue Liu, X. Zhou, 2005, "A novel license plate localization method based on Textural feature analysis", Proceedings on IEEE International Symposium on Signal Processing and Information Technology, 275-279.
[4] Duan, T.D., T.L.H. Du, N.V. Hoang, 2005,"Buildingan automatic vehicle license-plate recognition system", Proceedings of International Conference on Computer Science, 59-63.
[5] Vladimir Shapiro, DimoDimov, Stefan Bonchev, Veselin Velichkov, and Georgi Gluhchev "Adaptive License Plate Image Extraction", Proceedings of the International Conference on Computer Systems and Technologies - CompSysTech'2003.
[6] Dr. Neeraj Bhargava, Anchal kumawat, Dr. Ritu Bhargava, "Threshold and binarization for document image analysis using Otsu's Algorithm", International Journal of Computer Trends and Technology (IJCTT), vol.17, no.5, pp.272-275, Nov 2014

AUTHORS' BIOGRAPHIES

Mrs Nora Naik

M.E in Information Technology from Goa University.

Assistant professor in *Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India.*

Ms Mayuri Patgaonkar

BE Students, Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India.

Ms Gautami Pangam

BE Students, Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India.

Ms Neha Navelkar

BE Students, Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India.

Ms Shivani Rivonkar

BE Students, Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India.

Ms Sweta Kumari

BE Students, Dept. of Computer Engineering, Agnel Institute of Technology & Design, Goa, India.