



# RECOGNITION OF VEHICLE'S NUMBER PLATE USING MATLAB

Vedant Taide<sup>1</sup>, Ram Warutkar<sup>2</sup>, Nihal Nitnaware<sup>3</sup>, Milind Rane<sup>4</sup>

## ABSTRACT

**In this document, MATLAB is being used to extract and recognise a vehicle's number plate from a generated image of that particular vehicle. A digital camera is chosen to generate an image which includes the vehicle and its number plate. Extraction and recognition of the alphanumeric characters is done using the template images of the alphanumeric characters.**

**In case of various luminance conditions, extraction of number plate from a vehicle can be done using a specific algorithm using MATLAB. A text file is generated which contains the extracted images of number plate from a vehicle for verification purpose. Number plate identification proves to be helpful in car parking management system, finding a stolen car and identification of vehicle in traffic.**

## 1. INTRODUCTION

In the field of image processing, Number plate extraction has a great scope in terms of research. Vast amount of automated system have been proposed as well as developed and each of them has its pros and cons. This algorithm works on images that have been captured from a fixed angle parallel to the horizon in various luminance conditions. It needs to be assumed that the vehicle is stationary at a place and that images captured are at a fixed distance.

Using MATLAB, the image is first captured with the help of a digital camera and later converted into a Greyscale image for pre-processing. After this conversion, unwanted holes in image have been filled by the virtue of the dilation process. Unwanted noise from image is removed using the low pass filters. After

removing the noise, image is segmented and the region of interest is extracted, and further the image is converted into its binary form. Binary images are easier to process as compared to the coloured images. After conversion of the image into its binary form, extraction of the alphanumeric characters from the number plate is done followed by their recognition with the help of their template images. Finally, each alphanumeric character is stored in a file, thus resulting into the successful extraction of the complete number plate.

## 2. LITERATURE SURVEY

Chittode J S et al. [1] developed an algorithm which is applied to monitor and manage car parking systems. Algorithm is used for number plate recognition which is being developed on the basis of morphological operations. The recognition of characters in number plate is done with the help of optical characters.

Peng H et al. [2] presented an algorithm named "Document Image Recognition" (DIR). DIR is the best approach used to find the most similar template for input image in a database. Chunyu C et al. [3] presented a technique for recognition of number plate from vehicle image which is implemented using MATLAB in which characters are recognized using edge detection segmentation and pre-processing of an image.

Lekhana G.C et al. [4] developed an efficient real time on-line Number plate recognition system. NPR algorithm consists of series of steps starting with image acquisition, segmentation of characters using spectral analysis and recognition of characters.

Paunwala C.N et al. [5] proposed a methodology which finds ROI using morphological

processing and directional segmentation. The ROI is the area which includes the number plate from which alphanumeric characters are recognized. This method is tested on different databases which contain images.

Singh M et al. [6] developed an efficient approach working on opening and closing of the morphological operations. First, the localization of plate in image has been done, then skew correction is done for segmenting the alphanumeric characters. In the end, Recognition is done using the template matching.

Kranti S et al. [7] presented an approach for number plate extraction named “Feature based number plate localization “. This methodology concentrates on two methods, namely the edge detection and the window filtering methods. Both methods are applied in this approach and produce efficient results. Ganapathy V et al. [8] developed a methodology exclusively for Malaysian vehicles. This methodology is focuses on the Hough transform and morphological analysis, thus resulting into extraction of the number plate with an accuracy of 95%.

### 3. METHODOLOGY

Flowchart is used below to show methodology. MATLAB is used to provide all image processing functions and toolbox. MATLAB has large library functions and set of tools.

Some of the features of MATLAB are:

1. For high numerical computation, MATLAB provides an advanced algorithm.
2. It has an ability to define user-defined functions as well as a large collection of mathematical functions.
3. 2D and 3D graphics are supported for plotting and displaying the data
4. If you are new to MATLAB, there is an online help option for your help.
5. It provides powerful, effective and efficient matrix and vector oriented high-level programming language.
6. Several toolboxes are provided for solving domain specific problems such as Image processing toolbox. Fuzzy logic, Digital

signal processing toolbox, neural network toolbox etc.

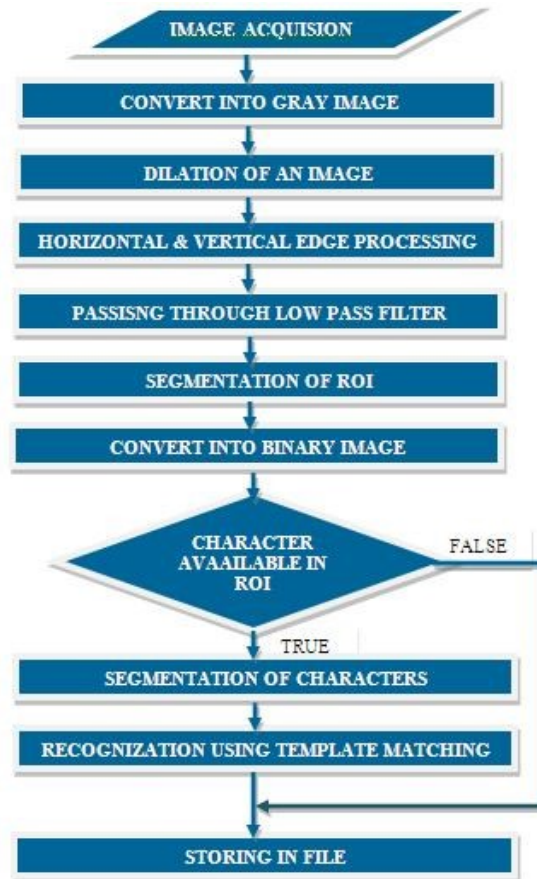


Figure 1. Flowchart

#### Step 1: Image Acquisition

In this step, digital camera is used to capture the image first. Image needs to be taken from a fixed angle parallel to horizon and the vehicle should be stationary. Image taken by a digital camera is shown in figure 2.



Figure 2. Input Image Taken From A Digital Camera

*Step 2: Convert into Gray image*

This step includes working on Gray level image, for pre-processing and identification of the required information. Coloured image needs to be converted into the Gray scale image. Gray scale image is shown in figure 3.



Figure 3. Gray Image

*Step 3: Dilation of an Image*

This step includes the dilation of the image. Dilation is a process of filling holes in an image, sharpening of the edges of an object, maximizing the brightness and connecting the broken lines. Dilation can get rid of unwanted noise from the image. Dilated image is shown in figure 4.



Figure 4. Dilated Image

*Step 4: Horizontal & Vertical edge processing*

Horizontal and Vertical histograms are used to denote the column-wise and row-wise histograms. These histograms depict the row-wise and column-wise sum of difference of Gray scale values amongst neighboring pixel values. Horizontal histogram is calculated first by traversing each column then vertical histogram is calculated later by traversing each row.

*Step 5: Passing histograms through low pass filter*

Histogram values are made to pass through the low pass filter since the values of histogram between consecutive rows and columns change drastically. Histogram value is averaged out among both sides. This step is done for both horizontal as well as vertical histograms. All the unwanted regions of an image are removed with the help of filtering. Passing of the histogram through a low pass filter is shown in figure 5 and 6.

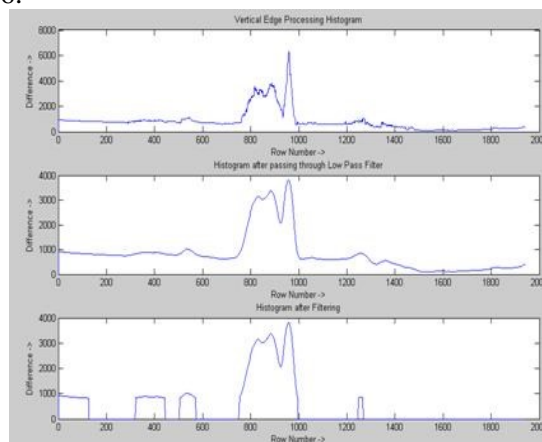


Figure 5. Vertical Edge processing

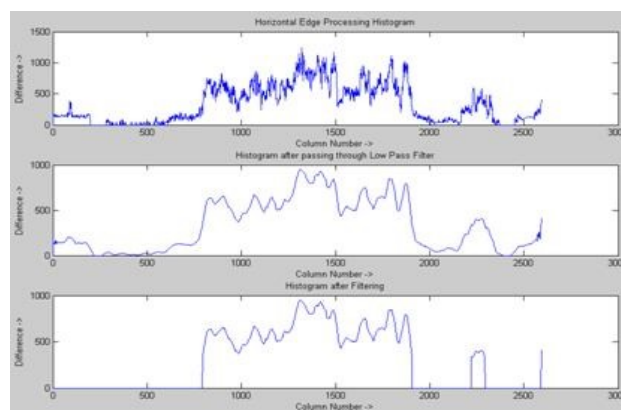


Figure 6. Horizontal Edge Processing

*Step 6: Segmentation of Region of Interest*

Segmentation of the image is being done. This step includes identification of all the regions which have probability of license plate and further, storing of coordinates of such probable region is done. The segmented regions are shown in fig7.



Figure 7. Segmented Image

*Step 7: Convert into Binary Image*

Image needs to be converted into binary image from its Gray scale image. Intensity change value is calculated effortlessly in binary image as compared to Gray scale and coloured image. Binary image is shown in figure 8.

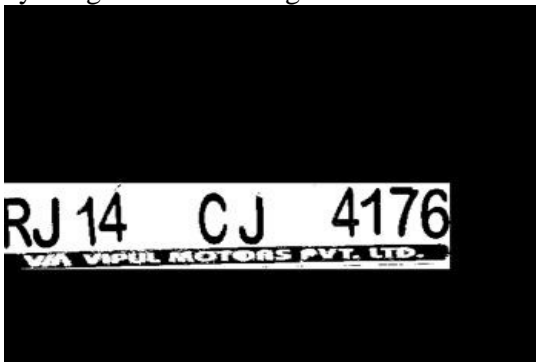


Figure 8. Binary image of extracted image

*Step 8: Segmentation of alphanumeric character*

Segmentation of each individual alphanumeric characters is performed. This segmentation has been performed by using smearing algorithms in both horizontal as well as vertical histograms. For filling the space in inner part of each character, the vertical smearing algorithm is used and some threshold value is being determined. Similarly, horizontal smearing algorithm is also applied. Extraction of each individual alphanumeric character is done by finding starting and ending points of character in horizontal direction. These characters are shown in figure 9.



Figure 9. Extracted characters from number plate

*Step 9: Recognition of individual character*

Template based recognition method is used for the recognition of each individual alphanumeric character. Segmented image is compared with one of the image which is stored in the database named as the template image. Best matched similarity is compared in both the images. This similarity is then compared with statistical method correlation. The image is best matched for which the correlation coefficient for template image is maximum. These template images are shown in figure 10.



Figure 10. Template Images



*Step 10: Storing in file*

After extraction of alphanumeric characters is done, number plate data is stored in a text file with complete information like characters on number plate and date on which it was extracted. This shown in figure 11.

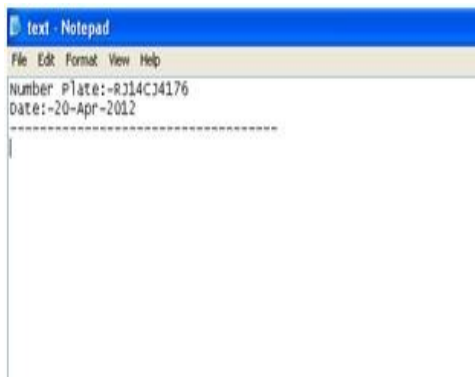


Figure 11. Extracted image is stored in a file

**4. RESULT**

The system works with an accuracy of 99% when images are captured from fixed distance and from the center position. It is assumed that vehicle should be stationary and image is captured from fixed angle parallel to horizon. Car number plate should be according to 1989 motor vehicle limited.

There are few limitations to this method, some of which are shown in figure 13. In these figures, either the system does not extract number plate from Gray scale due to some luminance conditions or due to problematic backgrounds.



Figure 12. Problematic images where number plate is not captured properly

**5. CONCLUSION**

Extraction from a number plate needs to be accurate while working on images of busy roads or parking systems. This method produces an efficiency of about 90% and has been tested on about 50 different vehicles.

**REFERENCES**

- [1] J.S. Chittode and R. Kate, "Number plate recognition using segmentation," International Journal of Engineering Research & Technology, Vol. 1 Issue 9, November- 2012.
- [2] H. Peng, F. Long and Z. Chi, "Document image recognition based on template matching of component block projections," IEEE transaction on Pattern Analysis and

- machine Intelligence, Vol. 25, no. 9, pp 1188-1192, sep 2003.
- [3] C. Chunyu, W. Fucheng, C. Baozhi and Z. Chen," Application of image processing to the vehicle license plate recognition," International Conference on Computer Science and Electronics Engineering, published by Allantis press, pp 2867-2869, 2013.
- [4] G. C.Lekhana and R.Srikantaswamy," Real time license plate recognition system," International Journal of Advanced Technology & Engineering Research, Vol-2, Issue-4, pp 5-9, July 2012.
- [5] C N Paunwala and S Patnaik, "A novel multiple license plate extraction technique for complex background in Indian traffic conditions," International Journal of Image processing, Vol-4,Issue-2,pp 106-118.
- [6] Pandya and M Sing," Morphology based approach to recognize number plates in India," International Journal of Soft Computing and Engineering,Vol-1, Issue-3, pp 107-113, June2011.
- [7] S Kranti and K Pranathi," Automatic number plate recognition," International Journal of Advancements in Technology,vol-2, no-3, pp408-423, July 2011.
- [8] V Ganapathy and W.L.D Lui," A Malaysian vehicle license plate localization and recognition system," Journal of Systemic and Cybernetics (pdf from freewebs.com)
- [9] O Khalifa, S Khan, R Islam and A Suleiman," Malaysian vehicle license plate recognition," The International Arab Journal of Information Technology, vol-4, no-4, pp 359-365, Oct 2007.