

### *NUMBER PLATE RECOGNITION USING MATLAB*

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#### ABSTRACT

Because of unlimited increase of cars, transportation system is not good; to manage and monitor the transportation system by human, automatic number plate recognition became very important in our daily life. This technology is used to detect the number plate of vehicle. ANPR can be assisted in detection of stolen vehicles. This can be done by using ANPR system that should be located on highways. This paper presents a identification method in which a vehicle image is taken and processed by using various techniques. This paper presents an approach based on simple but efficient morphological operation and Sobel edge detection method. This approach is simplified to segmented all the letters and numbers used in the number plate by using bounding box method. After segmentation of numbers and characters present on number plate, template matching approach is used to recognition of numbers and characters. The concentrate is given to locate the number plate region properly to segment all the number and letters to identify each number separately.

**INDEX TERMS:** ANPR, erosion, dilation, segmentation.

#### INTRODUCTION

In today s life vehicles play a very big role in transportation. Also the use of vehicles has been increasing because of human needs and population growth in recent years. So controlling of vehicles is the basic requirement. Due to the rapidly increase in number of

vehicles, number plate recognition system has become one of the most important digital image processing systems to be used. Real time ANPR (Automatic number plate recognition) system plays a major role in automatic monitoring of traffic rules on public roads. ANPR is used to identify vehicles by only their number plates. Since every vehicle carries a unique number plate, no external cards, tags or transmitters need to be recognizable, only number plate. Real time ANPR (Automatic number plate recognition) system plays a major role in automatic monitoring of traffic rules on public roads. ANPR is used to identify vehicles by only their number plates.<sup>[1]</sup> Since every vehicle carries a unique number plate, no external cards, tags or transmitters need to be recognizable, only number plate.

The field of ANPR and its application has attracted many researchers to search and develop systems which can process images and get useful information from them. Most previous researches and applications have faced some kind of poor performance due to the diversity of plate formats, the non uniform outdoor illumination conditions during image acquisition, noisy patterns connecting characters and poor edge enhancement.

Optical character recognition is a method that is used on images to read the license plates on vehicles. The license plate recognition has special type of OCR technology that is considered strictly a type of technology - mainly software - that lets us scan paper documents and turn them into electronic, editable files. License plate recognition (LPR) is a type of technology that enables computer systems to read automatically the registration number (license number) of vehicles from digital pictures. Reading automatically the registration number means transforming the pixels of the digital image into the ASCII text of the number plate.

They are used by various police forces and as a method of electronic toll collection on pay-per-use roads and monitoring traffic activity, such as red light adherence in an intersection. ANPR can be used to store the images captured by the cameras as well as the text from the license plate, with some configurable to store a photograph of the driver.

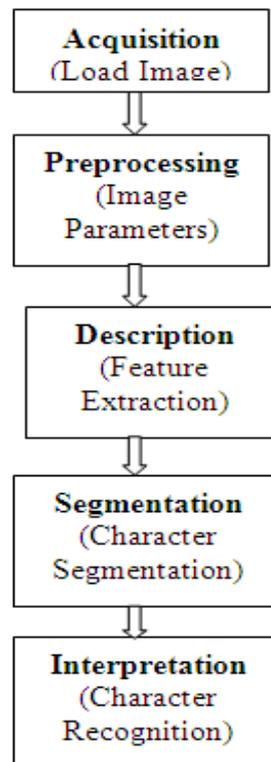
From the ANPR point of view the image quality is always key factor.<sup>[2]</sup> Capturing of fast moving vehicles needs special technique to avoid motion blur which can decrease the recognition accuracy dramatically. To ensure the right image quality short shutter time need to be used with the combination of high-power illumination. The best illumination is the IR, because the retro-reflective plates reflect this kind of light very well and it is undetectable for the human eye. This combination works fine during day and night and provides constant good

image quality. Only dedicated ANPR cameras meet these requirements, like AHR's ANPR cameras, which provide flexible shutter control with built-in IR flash and able to catch the vehicles up to 250km/h which is suitable for all kind of license plate reading applications.

ANPR technology tends to be region-specific, owing to plate variation from place to place. The objective of the paper is to successfully locate standard number plate, segment characters and recognize them given a car image. The system must deal with different angles, distances, scales, resolutions and illumination conditions.

### Structure of ANPR System

Blocks of general NPR system are discussed below



**Fig 1: Block Diagram of ANPR system.**

#### ***Capture or Acquisition***

Acquisition is the process through which a digital image is obtained using a capture device like a digital camera, video camera, scanner, satellite, etc. The image of the vehicle whose number plate is to be identified is sample image.

#### ***Preprocessing***

Preprocessing includes techniques such as noise reduction, contrast enhancement, enhancement of certain details, or features of the image. In this step the number plate is

extracted by firstly converting RGB Image i.e., the captured image to Gray Scale Image.<sup>[2, 3]</sup> Here mathematical morphology is used to detect the region and Sobel operator is used to calculate the threshold value. After this we get a dilated image. Then imfill function is used to fill the holes so that we get a clear binary image.

### ***Description***

Description is the process that gets convenient features to differentiate one object from another type, such as: shape, size, area, etc.

### ***Segmentation***

Segmentation is the process which divides an image into objects that are of interest to our study. The recognition identifies the objects. Here bounding box technique is used for segmentation.<sup>[4]</sup> The bounding box is used to measure the properties of the image region. The basic step in recognition of vehicle number plate is to detect the plate size. Here the segmented image is multiplied with gray scale image so that we only get the number plate of the vehicle.

### ***Interpretation***

Interpretation is the process that associates a meaning to a set of recognized objects and tries to emulate cognition.

After undergoing the above steps the number plate is displayed in MATLAB window.

## **NPR Implementation Using MATLAB**

The entire process of NPR implementation using MATLAB is given below

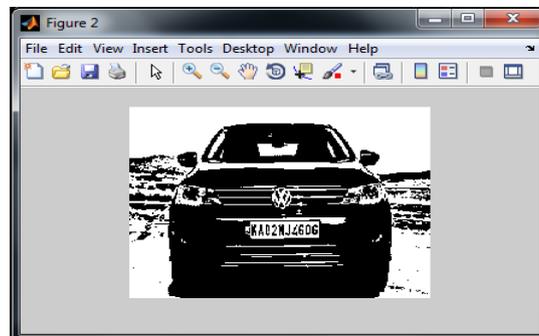
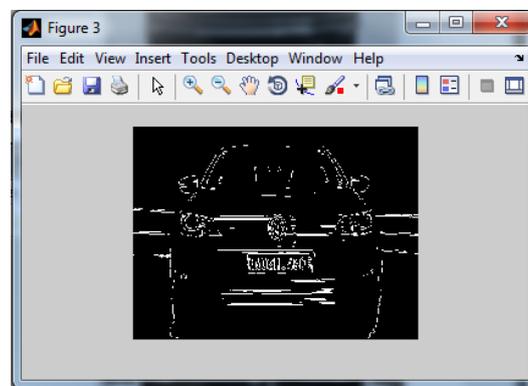
### ***a. Input image***



**Fig 2: Sample Image of Vehicle.**

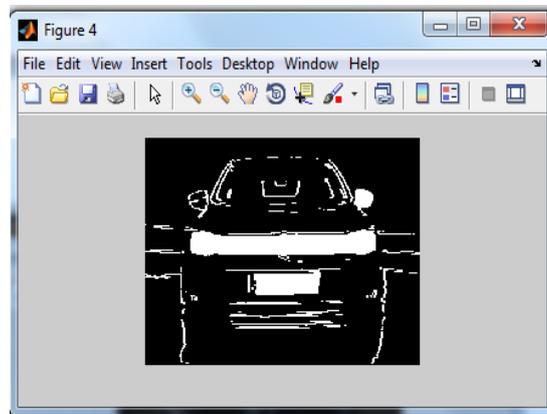
***b. Extraction of number plate location***

The sample image is first resized. Then sample image converted grayscale and then into binary so that it will contain only dark or bright values. Binary image is a digital image that can have two possible value of each and every pixel i.e. either black or white.<sup>[5]</sup> After converting into binary edge detection is done and the edges of image were obtained.

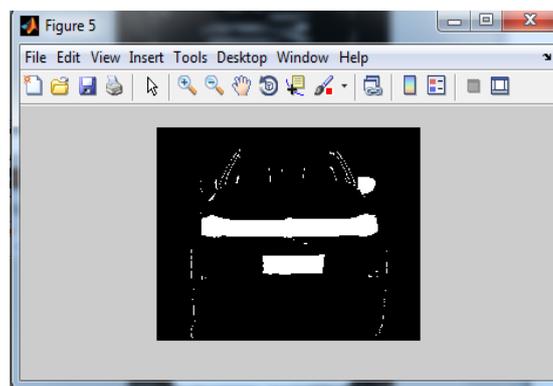
**Fig 3: Grayscale image.****Fig 4: Binary image.****Fig 5: Binary image with edge detection.*****c. Remove connected objects on border***

After obtaining the edges in sample image, image is dilated. After dilation, holes are filled in dilated image. After filling holes, erosion is done using a diamond shaped structure element.

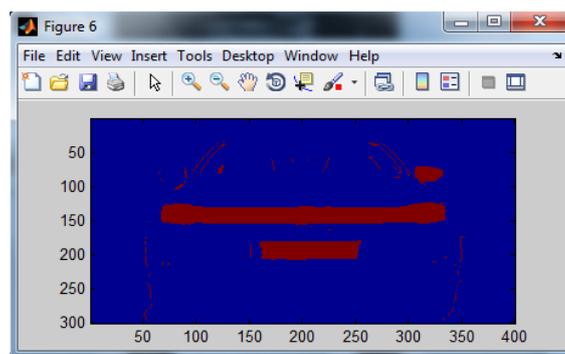
Structure element is an array having values 1 or 0 with a fix centre value. Through erosion three prominent rectangles were obtained out of which only number plated rectangle was required. By setting the limits of area of rectangles, other rectangles were removed and only number plated rectangle was obtained. After that the binary image is multiplied with extracted blank number plate image pixel by pixel to get the exact number plate with characters and numbers.



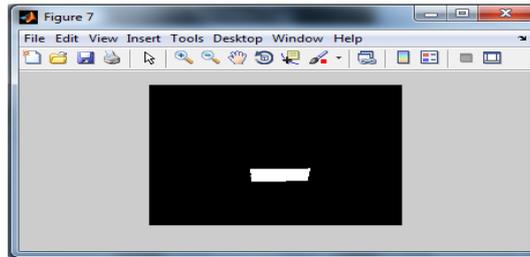
**Fig 6: Dilated image with filled holes.**



**Fig 7: Eroded image.**



**Fig 8: Scaled eroded image.**



**Fig 9: Extracted of number plate area.**



**Fig 10: Number plate of vehicle of sample image.**

#### *d. Character segmentation*

Character segmentation is an operation that seeks to decompose an image of a series of characters or numbers into sub-images of individual characters or numbers.<sup>[6, 7]</sup> Here character segmentation is done to differentiate each and every character and number displayed on the number plate of the vehicle.



**Fig 11: Number Plate with bounding box image.**



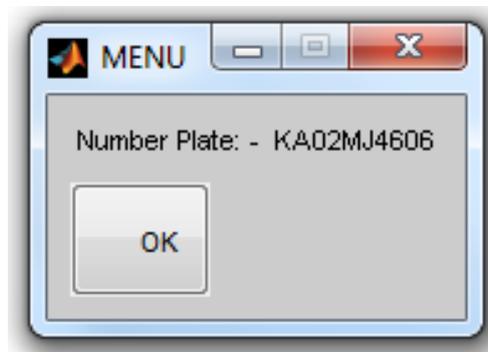
**Fig12: Image of each character and number.**

### *e. Character recognition and display the result*

Character recognition is the electronic conversion of images typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo. Character recognition can be done using different types of techniques. Here we used 3 techniques for character recognition namely template matching, neural network based character recognition and feature based character recognition.<sup>[8]</sup> The segmented characters and numbers are compared with standard stored results of for recognition of characters and numbers to identify the extracted characters and numbers of number plate of vehicle.

### **MATLAB RESULT**

After character recognition from different techniques, the number plate of vehicle is displayed as a result.



### **RESULTS**

250 sampled images were taken and results from different character recognition techniques were obtained and analysis is done as follows

**Table 1: Results for different techniques used.**

Sr. No.	Technique Used for character recognition	Percentage of Accuracy
1	Template matching	240 images (96%)
2	Feature based	242 images (96.8%)
3	Neural network based	248 images (99.2%)

### **Applications of NPR System**

License Plate Analyzer has a wide variety of law enforcement, monitoring and commercial applications for various environments. Possible applications include:

- Car park management
- Automated real-time alerts to unauthorized vehicles

- Toll booths
- Traffic and parking flow surveys
- Site access control

## CONCLUSION

The objective of this paper was to study and resolve various problems regarding aspects of the automatic number plate recognition systems. The main purpose is to create an ANPR system. ANPR system was applied on pictures taken of different number plates of vehicles. Here we have used three techniques for character recognition. From results we can conclude that neural network based character recognition technique gives best result among all three techniques used.

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