# VEHICLE NUMBER PLATE IDENTIFICATION USING MATLAB

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## Abstract:-

Video surveillance system is used for security purpose as well as monitoring systems. Automated systems have been designed for numerous detection tasks. The detection of vehicles by their number plates is the most interesting and challenging research topic from past few years. It is observed that the number plates of vehicles are in different shape and size and also have different color in various countries.

This paper presents an approach based on simple but efficient morphological operation and Sobel edge detection method. This approach is simplified to segment 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, a different approach is used to recognition of numbers and characters. The concentration is given to locate the number plate region properly and to segment all the number and letters to identify each number separately and then to convert all the segmented images into text and display the result and store it in database.

**Keywords:** Automatic Number Plate Recognition (ANPR), MATLAB, Character segmentation, Thresholding, Edge Detection, Character Recognition.

## 1. Introduction:-

With increasing number of vehicles on roads, an automated system is required to easily identify a vehicle. It can be identified by its number plate. Various license plate detection algorithms have been developed in past few years. Each of these algorithms has their own advantages and disadvantages. This project described the method in which license plate is detected in Matlab. As multiple detections are available for single license plate, post-processing methods are applied to merge all detected regions. CCTV cameras with trackers are used to limit the search region to certain areas in an image. It suggests a different approach of detection using binarization and elimination of unnecessary regions from an image. In this approach, initial image processing and binarization of an image is carried out based on the contrast between characters and background in license plate. After binarizing the image, it is divided into different black and white regions. These regions are passed through elimination stage to get the final region having most probability of containing a number plate.

In NPR system spectral analysis approach is used were acquiring the image, extract the region of interest, character segmentation using Neural Network feature extraction techniques. The advantage of this approach is success full recognition of a moving vehicle [1].

License plate location algorithm consist of steps like as Edge Detection, Morphological operation like dilation and erosion, Smoothing, segmentation of characters and recognition of plate characters are described in[2] [3][4][5][6].

At the end the system will extract the region of characters as image and then try to identify which character it is. The system is firstly, trained with images English Alphabet characters (A-Z) and whole numbers (0-9) and it is considered as a database. The test image is the extracted/segmented images of characters from the original image of car. The test image features are also extracted and then are compared with training image database. Based on the closeness measures (distance), the test image is considered to exist in a predefined class and then the output is generated automatically. If is can't recognize the character (which may arise due to color or different font), it will display the messages that the character can't be recognized.

## 2. Literature Review:

**Shidore M.M, Narote S.P**., in year 2011, proposed a paper "Number Plate Recognition for Indian Vehicles" [7]. In this paper, number plate extraction is done using Sobel filter, morphological operations and connected component analysis. Character segmentation is done by using connected component and vertical projection analysis. Character recognition is carried out using Support Vector machine (SVM). The segmentation accuracy is 80% and recognition rate is 79.84 %

**Prof. Kukreja1 Amit, Bhandari Swati et al**. presented a paper in April 2017 named "Indian Vehicle Number Plate Detection Using Image Processing" [8] in which they proposed a system for localization of number plate for vehicles in India and segmented the numbers as to identify each number separately. The whole process was dived into two steps; one is to locate the number plate and second is to segment all the number and letters to identify each number separately. The project is developed using MATLAB7.4.0.

In journal Recognition of Vehicle Number Plate Using Image Processing Technique [9] by **Patel Faizal, Solanki Jamini et al.** presented a system which is utilized to detect and identify the number plate of a particular vehicle and store the data into text form. Along with Sobel edge detection technique, the morphological operation is used to detect the number plate characters followed by segmentation approach, in which bounding box procedure is utilized to segment and extract each character from the number plate.After the segmentation, template matching approach is made use of to match the numbers and characters of the number plate.

In 2018, **Singh Narendra, Prakhar Sachan Prakhar et al**. presented a paper named "Vehicle number plate detection using matlab" [10]. The captured images are extracted by using the segmentation process. Optical character recognition is used to identify the characters. The obtained data is then compared with the data stored in their database. The system is implemented and simulated on MATLAB and performance is tested on real images. This type of system is widely used in Traffic control areas, tolling, parking area .etc. This system is mainly designed for the purpose of security system

## 3. Research Methodology:

Here we are trying to develop a system that can detect the number plate, extract the characters by using image processing technique and display them as text by training. The system is designed using MATLAB platform. The proposed system uses supervised learning in which first we train our system then test with segmented characters. This algorithm compares the test image and training image by calculating its mean and standard deviation and compares the images by subtracting the features of trained images and test images and determines students who are present and absent.

### 3.1 Image Processing In Matlab:

Image processing is the technique to convert an image into digital format and perform operations on it to get an enhanced image or extract some useful information from it. Changes that take place in images are usually performed automatically and rely on carefully designed algorithms.

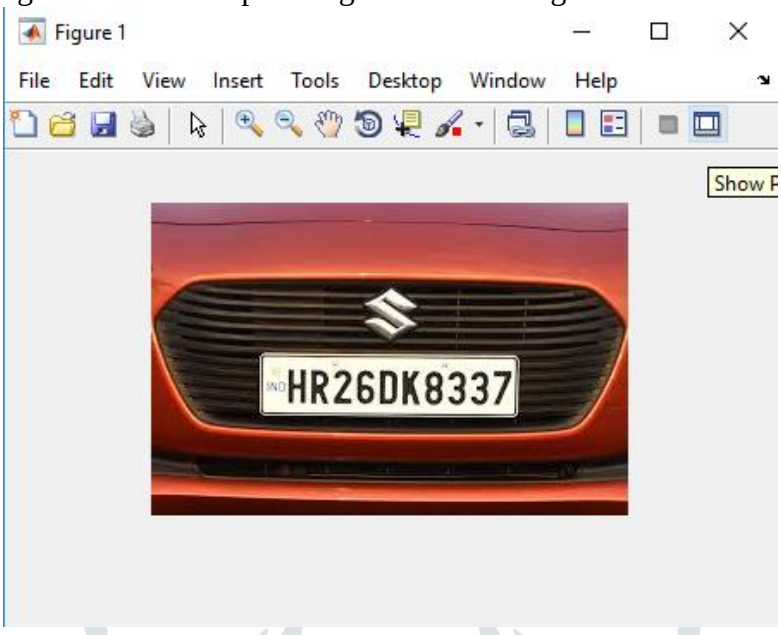
Image processing is a multidisciplinary field, with contributions from different branches of science including mathematics, physics, optical and electrical engineering. Moreover, it overlaps with other areas such as pattern recognition, machine learning, artificial intelligence and human vision research.

The need to extract information from images and interpret their content has been the driving factor in the development of image processing. Image processing finds use in numerous sectors, including medicine, industry, military, and consumer electronics and so on.

# 4. Methodology:

### 4.1 Capturing image from camera:

In this step the car whose license number plate is to be detected is captured by a CCTV camera. The image should be taken from a fixed angle such that only the portion of car plate area is captured. For the implementation an already captured image is stored in the system. And further processing is to be done on this image. The input image is 250×194. Input image is shown in figure 1

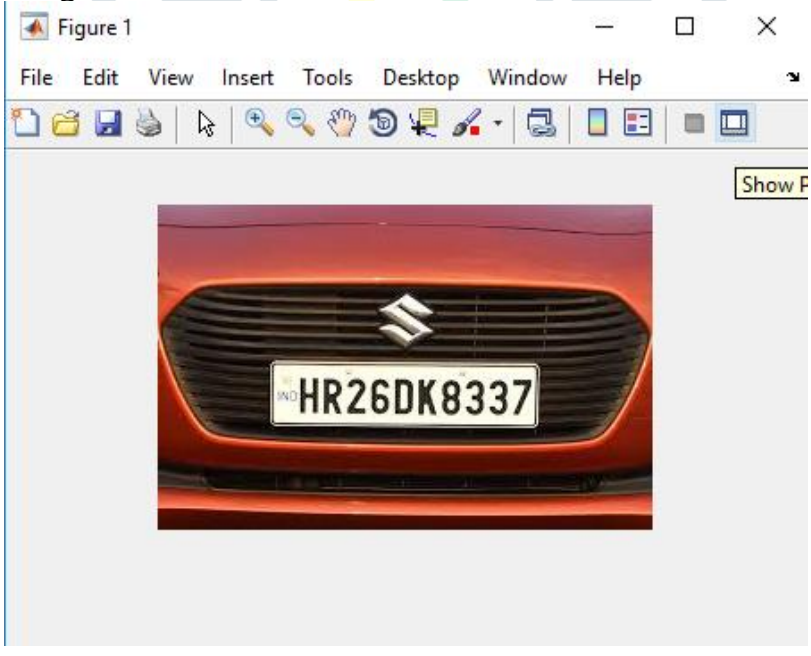



### 4.2 Extracting number plate region:

In this step the captured image is converted into a gray scale image from RGB image. From the image a threshold level is detected. And the remaining unnecessary area is removed. The region of interest is converted into more precise and clear binary image.

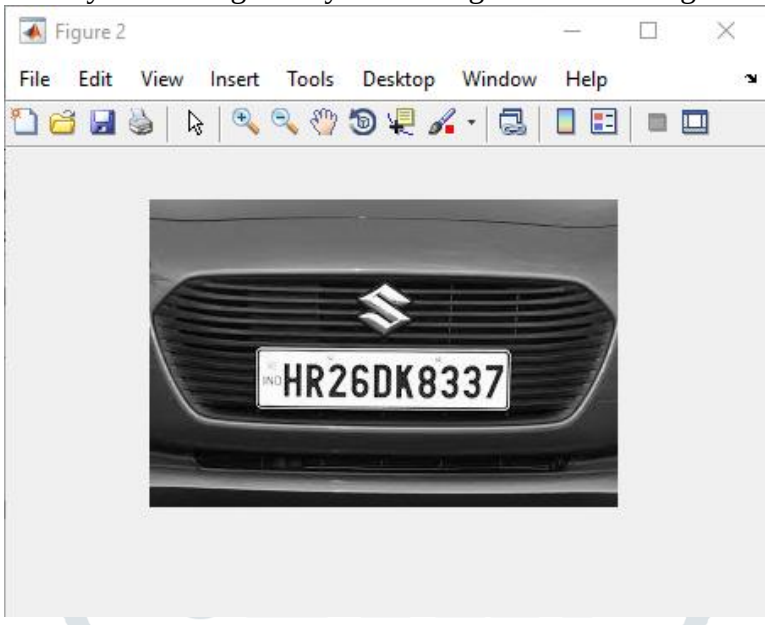
The entire process is involved in the detection of number plate is described below along with the methods used Capturing Image This is the very first step. The image is to be captured via CCTV camera.

### A: Loading Captured image



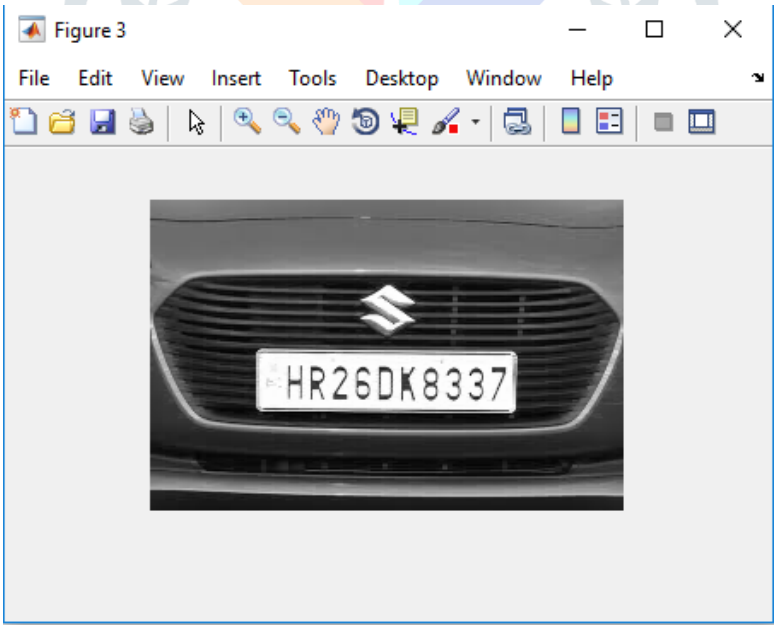
**B: Convert into Gray image**

Gray scale is simply reducing complexity: from a 3D pixel value (R,G,B) to a 1D value. This is because Grayscale images are more suitable for applications e.g. Image Segmentation. The image is in rgb format and our application needs a grayscale image. This algorithm works on Gray level image, for pre-processing and identifying the required information so we use the rgb2gray conversion. In this step colored image is converted into the Gray scale image. Gray scale image is shown in figure 2



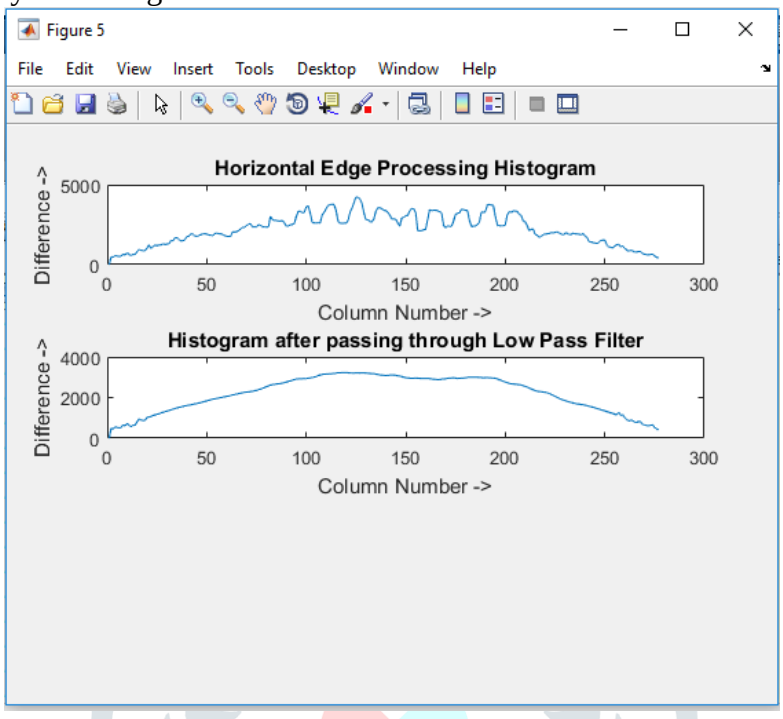

**C: Dilation of an Image**

In this step, image has been dilated. Dilation is a process for filling holes in an image, sharpen edges of an object maximize brightness and connect the broken lines. Dilation can remove unwanted noise from image. Dilated image is shown in figure 4.



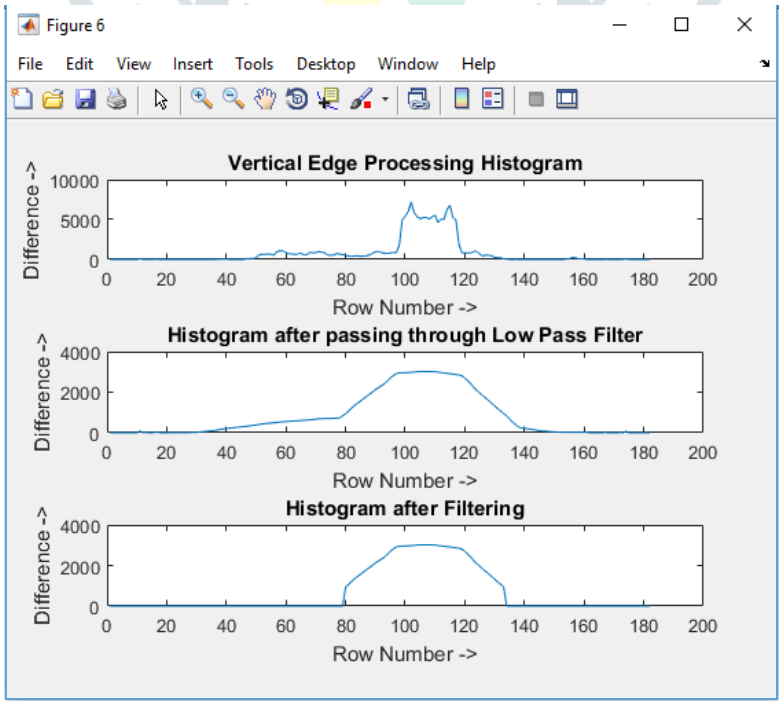
**D: Horizontal & Vertical edge processing**

Edge Detection is an image processing technique for finding the boundaries of objects within images. The edges are detected and the remaining unrequited part is eliminated so as the ease the detection of alpha numeric characters. Horizontal and Vertical histogram denotes the column wise and row wise histograms. These histograms represent the row wise and column wise sum of difference of Gray scale values among neighboring pixel values. Firstly, horizontal histogram is calculated by traversing each column then vertical histogram is calculated by traversing each row.



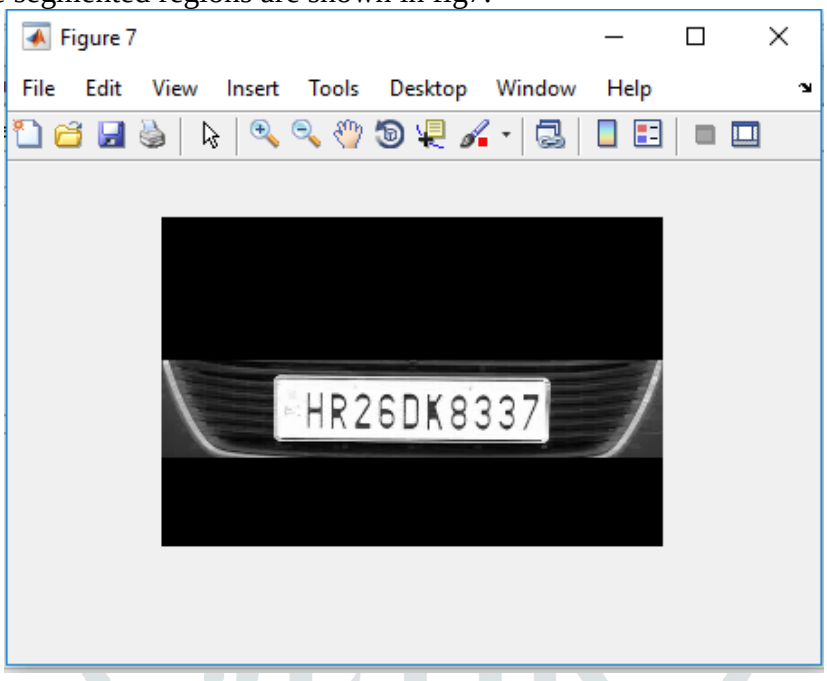

**E: Passing histograms through low pass filter**

Histogram values are passed through low pass filter because values of histogram between consecutive row and column changes drastically. This step is performed for both horizontal and vertical histograms. Filtering removes all the unwanted regions of an image. Passing histogram through low pass filter is shown in figure 6.



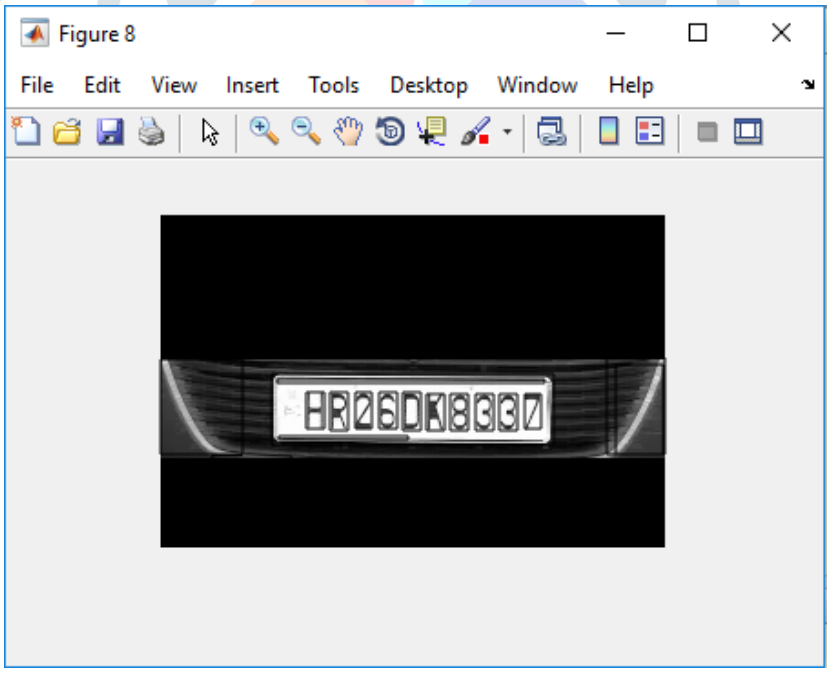
**F: Segmentation of Region of Interest:**

Image has been segmented. In this step all the regions which have probability of license plate has been identified and coordinates of such probable region has been stored. The following figure shows the segmented region. The segmented regions are shown in fig7.




**G: Extraction of region of interest**

From above segmented image, region with maximum histogram value is taken as the most probable region for number plate. Among all the regions, the region with highest horizontal and vertical histogram value is identified. This region is considered as highest possibility of containing number plate and is extracted shown in figure 8




**H: Segmentation of alphanumeric character**

Individual alphanumeric characters are segmented. Segmentation has been done by using smearing algorithms in both horizontal and vertical histogram. For filling space of inner part of each character the vertical smearing algorithm is applied and some threshold value is determined. Similarly, horizontal smearing algorithm is applied. Each individual alphanumeric character is extracted by finding starting and ending points of character in horizontal direction.

### 4.3: Character Recognition

The character recognition phase consists of two steps: 1) Creating database 2) Character normalization and feature extraction, 3) Character classification

Creating Database:

A database is created to store the features of the each character. The dataset consists of 170 characters. These characters include digits from 0 to 9 and English alphabets. Mean and standard deviation of each individual character in calculated and saved in database. To distinguish and group a set of particular character they are assigned class. For digits (0-9) class extends from 0 to 9 and for alphabets class extends from 10 to 30.

#### 4.3.1: Character Normalization and Feature Extraction:

Segmented images realized from the original image by image segmentation process above has certain limits which are needed to overcome before further processing. This is because the segmented images have variations in size. So, all the characters are normalized to predefined height (Vertical Length) in pixel. As the characters always have variable width (Horizontal Length), each character image is normalized to a size of 19X19. Soon after normalization again mean and standard deviation are calculated for each image and stored for testing.

#### 4.3.2: Character Classification:

Each individual segmented image's mean and SD stored in compared to that of the database. For the least or the nearest value corresponding class number is the output. Since the class result is in unique. The number is checked for the label that it represents.

## 5: Conclusion and Future Work:

For the future work we propose to convert the image into text and it in database by using neural network. The system can be trained with MINST or EMINST dataset where individual training of each data would not be required. It would also reduce load and save time. For Recognition of individual alphanumeric character, template based Recognition method is used. In template based algorithm, segmented image is compared with one image which is stored in database named as template image. In both images best matched similarity is compared. After extracting, number plate is stored in file with complete information like characters on number plate and date on which it is extracted**.**

## 6: Applications:

ANPR provides automated process to deal with the number plate for computer systems managing databases and processing information of vehicle movements. Some major applications are listed below:

**1. Parking:** ANPR system use cameras to identify the number plates of cars entering and leaving car park. They use this information to determine whether cars have overstayed, and they have left at the time.

**2. Tolling:** Tolls are a common way of funding the improvements of highways, motorways, roads and bridges: tolls are fees for services. Efficient road tolling reduces fraud related to non-payment, makes charging effective, reduces required manpower to process events of exceptions.

**3. Law:** Enforcement: Automatic number plate recognition is an ideal technology to be used for law enforcement purposes. It is able to automatically identify stolen cars based on the up-to date blacklist. Other very common law enforcement applications are red-light enforcement and over speed charging and bus lane control.

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