

Vehicle Number Plate Detection Using Image Processing and OpenCV-Python

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ABSTRACT: Vehicle number plate recognition is the most exciting and challenging research topic. Number plates are of different shape and size. Vehicle number plate recognition is a well-known proposal in today's world due to the rapid growth of cars, bikes and other vehicles. This automatic vehicle number plate detection system uses image processing technique for identification of the vehicle's number plate. In India the most common vehicle number plate used have yellow or white as background and black as foreground color. In this paper we proposed a system for localization of number plate for vehicles in India and segmented the numbers as to identify each number individually. This has two steps; one is to locate the number plate and second is to segment all the number and letters to identify each number individually.

KEYWORDS: Number plate recognition, Localization, Histogram equalization, Sobel Edge Detection, Character Segmentation.

I. INTRODUCTION

Vehicle Number Plate Detection is a part of digital image processing used to categorize the vehicle. This includes many applications such as, traffic violation control, tracing of stolen vehicles etc. In India, the number plate containing white background with black foreground color is used for private cars and for the commercial vehicles yellow is used as background and black as foreground color. The number plate starts with two-digit letter "state code" followed by two digit numeral, followed by two letter and a four digit unique number. Nowadays many vehicles are being stolen and sold to others illegally. This can be reduced by taking snapshots from the surveillance cameras around the city and also cameras is the toll booths. This 'photograph' is then fed in a computer system to find out details about the driver and owner of the vehicle and details about the vehicle itself. Noise on the number plate can sometimes cause error and low accuracy. There are some limitations that lead to failure in most practical applications due to the diversity of the number plate characteristics and the intricacy of the natural environment like rain, snow, for etc. we anticipated a method mainly based on edge detection and morphological operation and decrease the noise using mid-filtering noise removal method. The system for vehicle number plate detection includes a camera, a computer, and custom designed software for image processing, analysis and recognition.

II. RELATED WORK

There are various techniques for plate detection and segmentation algorithm to implement vehicle number plate detection. In [2] authors have used high resolution LPR cameras which are designed to take photographs at high pixel resolution so that it won't have too much noise. This also helps the system in segmenting the characters easily. In [3] authors have used pre-trained character classifier. The vehicle image on which VNLD is to be applied is then sent to the DetectPlates() function to get a list of all the possible license plates that are present in the image. Then the cropped license plates are passed to the DetectChars() function which gives the predicted number for each possible characters.

The character sequence is then returned in a string format and displayed as final answer. In [4] authors have used OpenCV, a library of programming functions for real time computer vision. The library has more than five hundred optimized algorithms. OpenCV provides complex and efficient adaptive thresholding algorithm. In [5] authors have used OCR (Optical Character Recognition) to detect the license plate number of the vehicles that are moving around. Once a new vehicle is detected, the proposed system detects the region of the plate and applies an algorithm to extract the image of the plate. In [6] authors have used Image binarization process to convert an image to black and white. In this method, certain threshold is chosen to classify certain pixels as black and certain pixels as white. The main challenge is the assigning of the threshold values for an image. In [7] authors have used Matlab toolbox function that delivers a function called regionprops(). It measures a set of properties for each labeled region in the label matrix. They have used boundingbox to measure the properties of the image region. After labeling the connecting components, the region will be removed from the input image. This is used for segmentation of characters.

III. PROPOSED ALGORITHM

In this paper, we discuss about Deep Neural Network algorithm for preprocessing. Deep neural networks compose computations performed by many layers. Denoting the output of hidden layers by $\mathbf{h}^{(l)}(\mathbf{x})$, the computation for a network with L hidden layers is:

$$f(\mathbf{x})=f[a(L+1)(h(L)(a(L)(\dots(h(2)(a(2)(h(1)(a(1)(\mathbf{x})))))))]].$$

Each preactivation function $\mathbf{a}^{(l)}(\mathbf{x})$ is typically a linear operation with matrix $\mathbf{W}^{(l)}$ and bias $\mathbf{b}^{(l)}$, which can be combined into a parameter θ :

$$a(l)(x)=W(l)x+b(l), a(l)(x^{\wedge})=\theta(l)x^{\wedge}, l=1 a(l)(h^{\wedge}(l-1))=\theta(l)h^{\wedge}(l-1), l>1$$

The “hat” notation x^{\wedge} indicates that 1 has been appended to the vector \mathbf{x} . Hidden-layer activation functions $\mathbf{h}^{(l)}(\mathbf{x})$ often have the same form at each level, but this is not a requirement.

Below Figure shows an example network. In contrast to graphical models such as Bayesian networks where hidden variables are random variables, the hidden units here are intermediate deterministic computations, which is why they are not represented as circles. However, the output variables y_k are drawn as circles because they can be formulated probabilistically.

IV. PROPOSED APPROACH

Since Image of Number plate would be captured in different contrast due to environmental causes. If the number plate is very similar to background it's difficult to identify the location. Illumination and contrast changes as light fall on to it. In this paper, the below morphological operations are used to eliminate the contrast feature within the plate.

The work is distributed into several parts:

- 1. Input raw image:** Input the image of car that is taken from the camera.
- 2. Reduce noise using mid-filtering method:** We used median filtering method to reduce noise. Noise reduction is a pre-processing step to remove the results for later processing.
- 3. Enhance contrast using histogram equalizer:** Using histogram equalization method the difference of each image is being enhanced. The function used to improvement that is, $J=\text{histeq}(k)$; where histeq enhances the contrast of the images by converting the values in an intensity image. When image pixel intensity of 8-neighbour connectivity, we supply a preferred histogram. histeq chooses the grayscale conversion T to minimize,

$$|h_1(T(k))-h_0(k)|$$
- 4. Image binarization:** From the input, color image has to be convert to gray scale and the 8-bit gray value is intended.
- 5. Plate localization:** The basic step in recognition of vehicle number plate is to detect the plate size. In general number plates are rectangular in shape. Hence identify the edges of the rectangular plate first. Mathematical morphology will be used to detect that region. Sobel edge detector is used to highlight regions with a high edge magnitude and high edge alteration are identified. Depending upon the threshold value edge will be detected from the input image. After edge detection eliminates all connected components that have lower than (eight pixel in our method) pixels. Thus it will produce another binary image.
- 6. Character segmentation:** OpenCV Library delivers a function which measures a set of properties for each labeled region in the label matrix. We use boundingbox to measure the properties of the image region. After labeling the connecting components, the region will be removed from the input image.

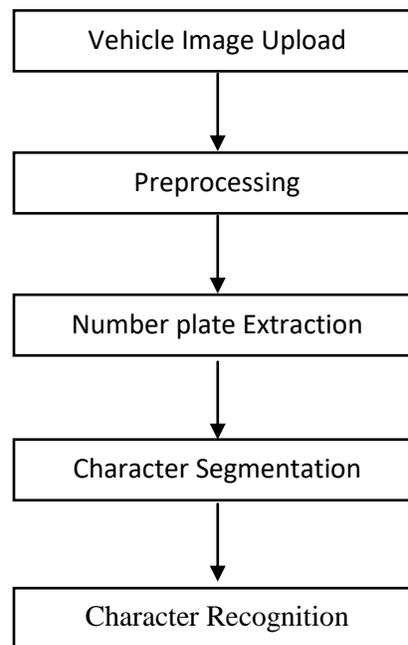


Figure 1: Flow chart of proposed method

V. RESULTS

Here are the steps that occur during the preprocessing of an image.

In Figure 2.1, raw image in which the number plate is visible is given as input. In figure 2.2, the input image is converted into gray scale to remove noise which helps in better image processing. In figure 2.3, Histogram equalization method is used to enhance the contrast of the image by converting the values in an intensity image. In figure 2.4, the equalized image is later Binarized to get a shallow view of the plate and its characters. In figure 2.5, Sobel Edge Detection method is used character recognition. It highlights regions with a high edge magnitude and high edge alteration. In figure 2.6, only the Plate region is extracted to detect the number plate in the Image. In figure 2.7, Characters being recognized and segmented individually. For character recognition we use deep neural network algorithm. In figure 2.8, result is displayed in string format.



Figure 2.1: Raw image of a car



Figure 2.2: Gray scale image



Figure 2.3: Histogram Equalization



Figure 2.4: Image Binarization

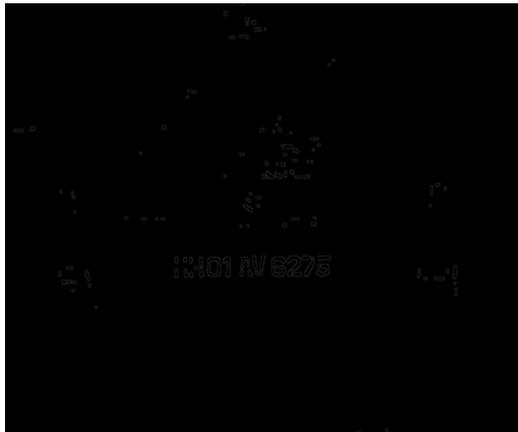


Figure 2.5: Sobel Edge detection



Figure 2.6: Extracted number plate



Figure 2.7: Character segmentation



Figure 2.8: Result in string format

VI. CONCLUSION

An efficient less time consuming vehicle number plate detection method is projected which performs Image Processing technique. The main aim of the study is to improve the performance of the system. By using OpenCV library we will be able to detect the number plate and characters in it. We have used python as our programming language which is a easy to read, learn and write. Our System is mainly based on Indian automobile number plates. Extraction of number plate accuracy may be increased for shallow ambient light image. Using these methods we can easily extract the characters



from a particular image. Preprocessing will be faster based on the angle and distance from where the photograph is taken.

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