

Advanced Number Plate Recognition Using Neural Network

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Abstract--Vehicles play an important role in our daily life. As a result there has been a rapid growth in the number of vehicles flying on the road. This causes difficulty in controlling the traffic. For advanced traffic management we have to keep track of the vehicles on the road. Here comes the importance of license plate recognition. Many methods are available for the detection of license plate. The propose method uses neural network for the recognition of the number plate. The main objective of this work is to develop an advanced method for license plate recognition that can reduce the recognition time and complexity.

Index Terms--Sobel Edge Detector, Neural Network, Feature Selection

I. INTRODUCTION

Traffic management is an important issue that we are facing in our society. Main reason for the difficulty in the management of traffic is due to the rapid increase in the number of vehicles.

Recognition of number plate plays an important role in managing vehicular traffic. The first Automatic Number Plate Recognition was invented in 1979 in UK by the Police Scientific Development Branch (PSDB). The field of ANPR and its numerous applications attracted many researchers and so the development in this area was rapid. The main difficulty faced by all of them were diversity in the plate format. The number plate format varies from country to country. Also the presence of noise degraded the performance of the ANPR system. Bad weather conditons have significant effect on the detection of the plate. The presence fog, smoke, mist etc makes the detection of characters more difficult. Sometimes these factors makes it non recognizable. These noisy patterns may connect the characters which in turn may cause confusion while detecting some characters like 2 & Z. Other factors that raises challenge to the researchers include poor outdoor illumination, speed of the vehicle, poor clarity of the camera etc. In India the main difficulty that are faced by the researchers is the absence of a standard format.

The license plate recognition system mainly have four steps. It include license plate image

location, Character Segmentation and Character Recognition.



Fig 1: General Block diagram

License Plate Image Location is the first step that we are doing. This stage involves locating the license plate that enclose the license plate numbers. This is an unavoidable step. After locating the license plate the extractor output is used by a segmentation part. This is also known as character separation. It isolates the characters in the number plate and this characters are used for further processing. The obtained result should be converted into binary for further processing.

The last and the most important step is the character recognition. This stage involves determining the numbers and characters in the plate. The success of this stage decides the accuracy and the recognition time of the project. There are many methods to do the character recognition. It involves template matching, Hough transform etc.

II. EXISTING METHOD

The main steps in this method is Plate region extraction, character segmentation and recognition. The image of the plate taken via camera is converted into binary. This binaries image is further used for processing. Smearing Algorithm is applied on this binaries image to find out the plate region. To obtain the plate location morphological operator is used. Dilation operator is used to separate the characters and the characters are normalized. The character recognition is done with the help of cross correlation.

III. PROBLEM DEFINITION

The main problems of the proposed method was

- a. high training time
- b. slow recognition
- c. fails to recognize 2 and Z
- d. complexity

The accuracy of the proposed method was acceptable. But it took high processing time. The main disadvantage is the large recognition time. The existing method took different time to recognize different number plate. This recognition time varies with the format of the number plate. The presence of the noise will also increase the recognition time. In case of blurred input image this algorithm will not give proper result.

IV. PROPOSED METHOD

Here an advanced technique for the number plate recognition is proposed. This technique uses neural network. That is why this technique is called advanced. The recognition of the character is done through this neural network.

The proposed method consist of two steps:

- [1] Preprocessing of number plate
- [2] Character recognition of the number plate

The preprocessing of the number plate involves locating the position the number plate and extraction of the characters in it. The recognition involves identifying the characters and numbers in the number plate. The Sobel Operator is used here for the detection of edge to identify the region of number plate. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations.

To analyze the performance peak signal to noise ratio (PSNR) and Mean Squared Error is used and is given by the following expressions.

$$MSE = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N |x_{ij} - y_{ij}|^2$$

$$PSNR = 10 * \log_{10} \left[\frac{L^2}{MSE} \right],$$

where L is the length.

MSE indicate the presence of error. As MSE increases PSNR decreases as both are inversely proportional.

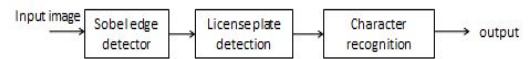


Fig 2: Block Diagram of Proposed Method

The input image is taken from the camera which is placed on the road. This is processed for further requirements. The sobel edge detector locates the edges of the number plate. Sobel method uses the derivative approximation to find edges. Therefore, it returns edges at those points where the gradient of the considered image is maximum. The horizontal and vertical gradient matrices whose dimensions are 3×3 for the Sobel method has been generally used in the edge detection operations. The remaining part of the image is removed and only the required part is processed. The detected plate is used for character recognition. The character recognition involves identifying the characters in the number plate.

V. EXPERIMENTAL RESULTS

The experimental results are as shown below. The original image is as shown below in figure 3. This is our input image and first we have to covert this to grey scale range.



Fig 3: Input Image

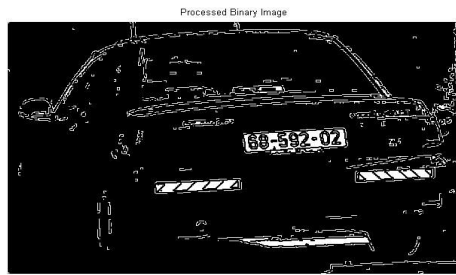


Fig 4: Processed Binary Input Image

Before edge detection we have to binarize the input image. This image is processed for further requirement. Next stage is edge detection using Sobel edge detector. The edge detection using Sobel edge detector enable us to locate the position where the number plate is located. The result is as shown in figure 5s.



Fig 5: Locating edge of the number plate

We have to remove the surrounding unwanted region and for that we are performing the extraction of the plate. This enable us to display the required part of the number plate.



Fig 6: Removing unwanted parts of input image



Fig 7: Plate extraction

The number plate itself may contain unwanted writings like that one shown in figure 5. The character recognition enable us to recover the characters in the plate. The final result thus obtained is as shown below.



Fig 8: Character recognition



Fig 9: Reference Image

To calculate the MSE & PSNR values we require a reference image. This image is made equal size as that of the input image. The we calculate the values of both parameters. The results obtained after the calculation of MSE and PSNR are shown in the table 1.

Table 1: PSNR & MSE Values

PARAMETER USED	OBTAINED VALUE
Peak Signal to Noise Ratio (PSNR)	60.8342
Mean Square Error (MSE)	0.054083

The MSE value is small. This indicates that the error that occurring is reduced. The MSE and PSNR values are inversely proportional.

VI. CONCLUSION

An advanced number plate recognition is implemented in MATLAB using Neural Network.

The main success of this project is the reduction in the computational complexity. The edge detection using Sobel edge detector is the main reason for this reduction. Also since we are using neural network for recognition there is a considerable reduction in the recognition time.

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