

Automated Number Plate Recognition System Using Machine learning algorithms (Kstar)

Er. Dinesh Bhardwaj¹, Er. Shruti Gujral²

¹²Computer Science and Engineering Department, Chandigarh University, Mohali, Chandigarh, India

Abstract: In this paper, a simple technique is presented for Automated Number Plate Recognition (ANPR) System, which can be used many applications for automated recognition of vehicle number plates. A simple algorithm is designed that can help to recognize number plates of vehicles using images taken by camera. The recognition of number plate's algorithm has five parts: Acquisition image, pre-processing, Edge detection and segmentation, feature extraction and recognition of character of number plates using suitable ML algorithms.

Keywords: Automated Number Plate Recognition, Number Plate Extraction, Segmentation and Feature Extraction, Character recognition.

I. INTRODUCTION

Vehicles play an eminent role in transportation. In India, vehicles have increased days to days. This is because of population growth, easy availability of domestic cars, and disproportionate ratio of assets [1]. ANPR is an image processing technology used to identify vehicles by taking only number plate as a parameter. It can be used in many applications such as entrance admission, Traffic control, security control, parking control, airport, speed control, harbor cargo control, road traffic control and so on. Every country uses their own way of designing and allocating number plates to their country vehicles. All of them India is one of country which used number plate of vehicles own way design. These number plates are then used by various government offices for their respective regular administrative task like- traffic police tracking those who are transgressing the traffic rules, to identify the theft cars, in toll collection and parking allocation management etc. The main aim of this paper is to purpose an efficient method for ANPR.

M.A. Massoud et al. [1] presented a new and simple technique for Egyptian vehicle's using video stream. Because it provided real time capability and did not required any additional sensor input such as infrared sensors. It provided a good direction and performance for ANPR in Egypt. V. Koval et al. [2] proposed an approach in which consists techniques like image fusion, threshold techniques and neural networks for identifying vehicle by recognizing its Number plate. The experimental results are shown good rate of recognize the license plate. the accuracy of recognized number plates are 97%. Shyang -Lih Chang et al. [3] proposed technique consisting of two modules in which one is a number plate locating module and other is number plate recognition. The former is characterized by fuzzy disciplines which attempted to extract number plates from an input image, while the latter had conceptualized in terms of neural subject's aims to identify the number present in number plate. Overall results of two techniques were 93.7%.Guangmin SUN et al. [4] proposed an important method for improving the number plate recognition rate of the network by using both the structure features and statistic features which included mesh feature, direction line element features and Zernike moments feature. Results showed that the method saved the time of training network and achieve a highly recognition rate.

Kumar Parasuraman et al. [5] presented a method based on the morphological algorithms and connected components analysis which comprised of four major stages: RGB to gray scale conversion, image binarization filtration, analysis and dilation and extracting the accurate location of the Number plate and character was extracted in efficient way A. Akoum et al. [6] proposed new approach of number plate recognition by using comparative study of different types of neural network. They used Hopfield and multilayer perception of neural network .it could be implemented by police to detect speed violators, highways, bridges, parking areas, or tunnels .The results had shown the ability of Hopfield network to recognize correctly characters on number plate with probability of 87% more than architecture which has a weaker performance of 80%. Kumar Parasuraman et al. [7] presented a new algorithm for recognize number plate system using SVM classifier which is called Support vector machine (SVM). The algorithm divided into two parts, one is character segmentation and other is recognition. This algorithm employed an SVM to recognize numbers and provided a good direction for automatic number plate recognition. Suhan Lee et al. [8] presented an image rectification method for increase performance of recognition of number plate. Existing techniques only deal with vehicle in fixed

view. However, in video, rotation is occurred and it decreases performance of recognition. An image rectification method showed that it assist to increase accuracy in case of pictured vehicles in rotated views. Amit verma et al. [9] proposed approach where image was stored in the form of a matrix and the output was displayed in the form of detected numbers. The overall work was to use Sobel Edge Detection technique. The result showed that it was simplest of all and with lesser complexity to detect the numbers.

Ashim Kumar Ghost et al. [10] presented recognition method for number plate of Bangladeshi vehicles with chain code and neural network. Database consisted of images with different size, camera angle, lighting, background, and distance etc. The experimental results showed that Number plates were extracted with 90 % accuracy. Khader Mohammad et al. [11] proposed method presented a novel number plate segmentation technique with three sets of feature vectors was used with template matching to form the two main modules: one was license plate localization module and other was LPR module. The presented model showed that despite the negative impact of shadows, cracks and character separations, the system demonstrated an overall success rate of accuracy 93%.

Fikriye Ozturka et al. [12] proposed method was designed an algorithm that plate was localized using Otsu's thresholding method and the plate features and character segmentation are used for Vertical and horizontal histograms. Final step of character recognition was done by Probabilistic Neural Networks. Simulation results were included with accuracy 97%. Lisheng Jin et al. [13] proposed approach presented a solution for the license plate recognition problem in China's number plate. Number plate images were pre-processed through gradation, edge detection and middle value filters. A character classifier was recognized using a fuzzy recognition method which was proposed based on the fuzzy decision-making method. Experiments showed that the recognition accuracy rate was up to 92%.

Shan Du et al. [14] presented a comprehensive survey on existing ANPR The future research of ANPR should concentrate on multistyle plate recognition, multiplates processing, high definition plate image processing. Silvia Mabel Castro et al. [15] presented a novel approach to solve the OCR problem using intelligent template matching in the context of solving the ANPR problem for Argentinean license plates. They introduced a new method for OCR, called ITM, with no need of prior training, obtaining a performance in time and accuracy comparable to ANN, while keeping the flexibility and simplicity of original template matching method. The need, applications and Literature survey of ANPR are discussed in section I. Vehicles images database is explained in Section II. Section III gives the proposed methodology. Conclusions and Future scope are discussed in Section IV.

II. Databases

The database consists of 320 images of various vehicles (front & rear) captured using 8 Megapixel mobile cameras with images of good quality (high resolution: 1200x1600 resolutions).

III. Proposed Methodology

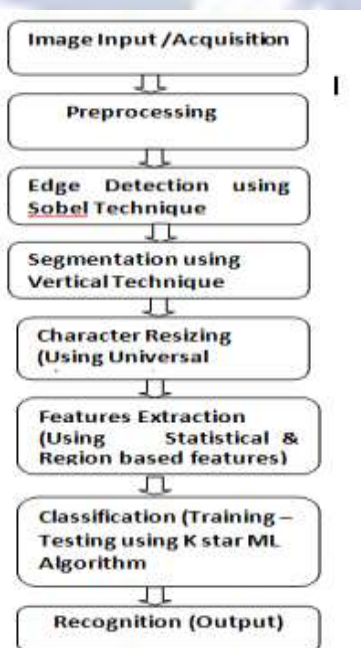


Fig 1: Proposed Method for Recognition of number plate

The proposed work is divided into following:

- Image Input /Acquisition
- Preprocessing
- Edge Detection And Segmentation of Number Plate Character (Sobel And Vertical Segmentation)
- Feature Extraction (Using Statistical & Structure Features)
- Classification(Testing-Training) Using Kstar ML Algorithm
- Recognition Of Number Plate

A. Image Input /Acquisition:

In this work, Image is capture using high resolution camera at different distance, different resolution conditions. Images are resized to (1200x1600 to 320x240).

B. Preprocessing:

1. Gray scale conversion: Firstly we need to convert image RGB to grey scale. We have only two colors in image it is easily to remove noise in images.

2. Noise removal using Median filter:

The mostly noise found in number plate images are salt and pepper noise, speckle noise etc. median filter which is more suitable than other. Median filter is a non-linear filter which replaced the gray value of a pixel by the median of the gray values of its neighbors. The aim of this process is to increase and improve the visibility of the image so that we easily performed image processing steps and reached to accurate result.

C. Edge Detection And Segmentation Character (Sobel And Vertical Segmentation):

1. Edge Detection:

In this work, we have aimed to extract number plate in whole image. There are number of algorithms used studied in literature survey but no one gave good result. From result, we found that sobel is good algorithm for edge detection of number plates. The pattern and concentration of the vertical edges also remains in conformity with the pattern of the number plate

II. Segmentation:

In the segmentation stage, an images consisting of sequence of characters are decomposed into sub-images of individual characters. There are two types of process which are used to segment character in image. One is Vertical segmentation and Horizontal process is used for this process. In the proposed system, we used Vertical segmentation [23].

D. Character Recognition:

ANPR systems may have some difficulties. Due to the camera adjustment and zoom factor, the extracted characters did not have the same size and the same thickness. These are as follows:

- a) Character Normalization: When we Segmented characters in number plate which have variation in size of characters of number plates. In this work, using universal discourser, all the characters are normalized to predefine valued in pixel.
- b) Feature Extraction: After resized characters of number plate, next step is features of each character. For this we are used six features on this basis we finds out characters and numbers of vehicles plates.6 Zonal features are extracted for the entire image based on the regional properties namely:

Sr. No.	Features
1	Euler Number
2	Eccentricity
3	Orientation
4	Extent
5	Perimeter
6	Convex

Fig 2: Table of feature

c) Classification and Recognition: The characters are recognized in the character recognition phase by classifiers such as Lazy K star ML algorithm. K star gives better performance as compared to other ML algorithms such as MLP, Bayes etc. So we are used Kstar algorithms for classification and recognized.

V. Experimental Result

a). Image Input /Acquisition:



Fig.3: (a) Original image (b) Gray scale of image (c) Noise remove

b). Sobel vertical edge detection:

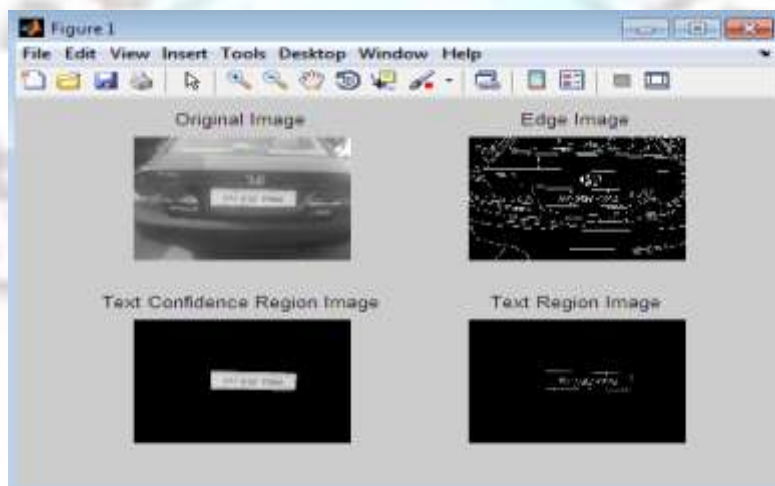


Fig 4: Sobel vertical edge detection.



Fig 5: Extraction of image

c) Segmentation of Extraction Number Plate

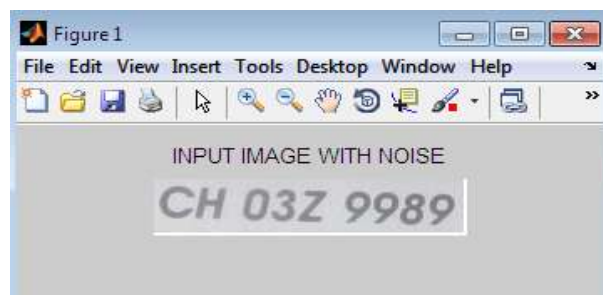


Fig 6: Image with Noise

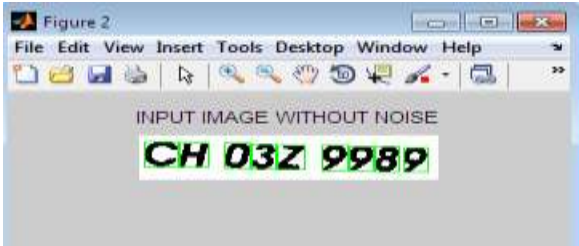


Fig 7: Segment input image without noise



Fig 8: Image Segmentation



Fig 9: Mannual Cropping Segment Character

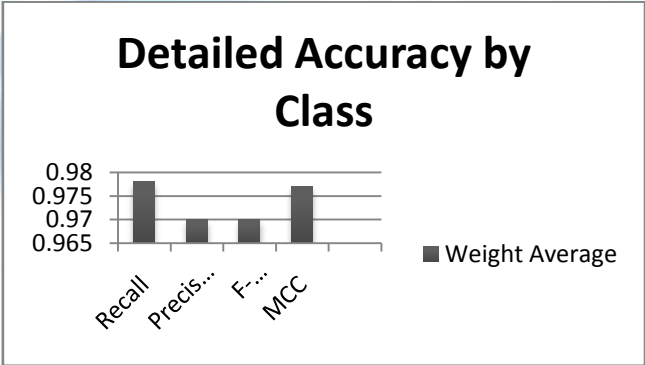


Fig 10. Classifier results *Kstar

Table: Detailed Accuracy by Class using *Kstar

Characters/numbers	No. of samples	Accuracy %
1	25	100
2	5	60
3	28	100
4	6	100
5	16	100
6	18	100
7	15	100
8	13	100
9	11	100
0	31	100

A	14	100
B	17	100
C	12	70
D	6	100
H	14	65
K	1	100
L	3	100
M	2	100
P	17	100
Q	4	100
R	5	100
S	2	100
T	2	100
V	4	100
W	4	100
Y	2	100
Z	2	100

Conclusion

In this work, we have presented technique to recognize number plate of vehicles. For this, we introduced Image capture, preprocessing, edge detection, segmentation, character resizing, feature extraction and finally recognized character of number plate using Kstar ML algorithms on Indian plates. We tried to increase speed of recognize number plates algorithms. Dataset creation consisted number of images which are collected real times, parking and etc. It has been found that other characters do exist in number plate besides vehicle own registered number. To deal with such erroneous characters, character analysis has been applied using our machine learning algorithm. For such systems, still we have to make few changes to our Purposed system. Future work lies in producing more accurate results with lesser response time according to the prescribed specifications of Indian vehicle number plates and automated system software is to be developed in future work.

References

- [1]. Satadal Saha et al (2009)," License Plate Localization from Vehicle Images: An Edge Based Multi-stage Approach" International Journal of Recent Trends in Engineering.
- [2]. M.A. Massoud et al. (2013)," Automated new license plate recognition in Egypt" Alexandria Engineering Journal 52, 319–326.
- [3]. V. Koval et al. (2003), "Smart License Plate Recognition System Based on Image Processing Using Neural Network" IEEE , International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications .
- [4]. Shyang-Lih Chang et al. (2004),"Automated License Plate Recognition", IEEE Transactions on Intelligent Transportation Systems, Vol.5, NO.1.
- [5]. Guangmin SUN et al. (2010), A new recognition method of vehicle license plate based on genetic neural network" Beijing University of technology,IEEE,978-1-4244-5046-6/10. Extraction and Character segmentation" IEEE International Conference on Computational Intelligence and Computing Research, ISBN: 97881 8371 362 7.
- [6]. A.Akoun et al. (2009), "Two Neural Networks for License Number Plates Recognition "journal of Theoretical and Information Technology.
- [7]. Kumar Parasuraman et al. (2010), "SVM Based License Plate Recognition System" IEEE: International Conference on Computational Intelligence and Computing Research.
- [8]. Suhan Lee et al. (2013)," Vehicle Model Recognition in stream Video", International Journal of Signal Processing, Image Processing and Pattern Recognition.
- [9]. Amit verma et al. (2010)," Vehicle Number Plate Detection using Sobel Edge Detection Technique" IJCST ,Vol. 1, Issue 2.
- [10]. Ashim Kumar Ghosh et al. (2011)," Automatic License Plate Recognition (ALPR) for Bangladeshi Vehicles " Global Journal of Computer Science and Technology, ISSN: 0975-4350.
- [11]. Khader Mohammad et al. (2013)," Arabic License Plate Recognition System "Columbia International Publishing Journal of Signal Processing Theory and Applications.
- [12]. Fikriye Öztürk et al. (2011), "A New License Plate Recognition System Based on Probabilistic Neural Networks" Procedia Technology 1 , 124 – 128.
- [13]. Lisheng Jin et al. (2012)," License Plate Recognition Algorithm for Passenger Cars in Chinese Residential Areas " licensee MDPI, Basel, Switzerland, ISSN 1424-8220.
- [14]. Shan Du et al. (2013)"Automatic License Plate Recognition (ALPR): A State-of-the-Art Review" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 23, NO. 2.
- [15]. N.F. Gazcon et al. et al(2012)," Automatic vehicle identification for Argentinean license plates using intelligent template matching" ,National Council of Scientific and Technical Research (CONICET) Av. Rivadavia 1906, 1033 Buenos Aires, Argentina, Pattern Recognition Letters 33 , 1066–1074.