International Journal of Engineering Research and General Science Volume 6, Issue 2, March-April, 2018
ISSN 2091-2730

A Training Based Approach for Vehicle Plate Recognition (VPR)

Laveena Agarwal[1], Vinish Kumar[2], Dwaipayan Dey [3]

[1]Department of Computer Science & Engineering

, Sanskar College of Engineering &Technology, Ghaziabad, India

[2]Department of Computer Science & Engineering

,Sanskar College of Engineering &Technology, Ghaziabad, India

[3]Department of Electronics & Communication Engineering

Bhagwant Institute of Technology, Ghaziabad, India

E-mail: robin.dey00@gmail.com

Abstract- From last few years, vehicle plate recognition (VPR) has become a vital technology of security and traffic applications. In this paper we present a training based approach for the recognition of vehicle number plate. The whole process has been divided into three stages i.e. capturing the image, plate localization and recognition of digits over the plate. HOG features have been used for the training purpose and Support Vector Machine (SVM) is employed for the classification purpose yielding in more than 99% accuracy while recognition. The algorithm has been tested over more than 100 images.

Keywords: Vehicle Plate Recognition (VPR), Support Vector Machine (SVM), Histogram of Gradient (HOG),Optical Character Recognition (OCR), Licence Plate Recognition (LPR)

I. INTRODUCTION

Now a days Vehicle plate recognition (VPR) has become a vital technology for security and traffic applications that have a wide range from traffic surveillance to parking lot access control to information management for monitoring purposes [1].[9],[10]. We can say, VPR helps to ascertain vehicles and provides a reference for further vehicle tracking and activity analysis [1], [12]-[16].

Automatic vehicle plate recognition (VPR) plays a significant role in huge applications such as parking fee payment, electronic toll payment, restricted area security, traffic surveillance [8]. In the detection of number plates, plate variations & environment variations occur because VPR technology operate under dissimilar environmental conditions such as circumscribed vehicle speed, fixed resolution, prescribed routes, specify range, rigid illumination [1]-[4], [8]. VPR technology discerns a vehicle's number plate number from captured image by camera. It includes object detection, pattern recognition and data image processing.

In order to verify the practicability of the VPR system it implemented over DSP i.e. TMS320C30 using Hough Transform for the detection of vehicle license plates [11][12][18].

Earlier the VPR systems were used as part of the surveillance systems. In [8] system was used as a part of intersection surveillance video camera system for traffic analysis.

Fig2: Character Segmentation

This paper is organized as following: Section I describes the steps involved for the vehicle plate recognition, Section II describes the proposed algorithm for the recognition, and section III contains the experimental results and discussions and finally the section IV sum up the paper with conclusion.

SECTION-I

Number plate recognition basically consists of three concrete steps. These are as follows:

1. Number Plate Extraction.

2. Character Segmentation.

3. Template Matching.

1. Number Plate Extraction

In this stage the input is an image of a vehicle, and a part of the image is output which contains the potential Number plate. The Number plate can lie anywhere in the image. To decrease the processing time, the Number plate can be distinguished by its features rather than processing each pixel in the image and therefore only those features pixels are processes by the system. Plate region is found out by passing a rectangular image over the previous.Fig.1 shows the extraction of plate.

Fig1: Extracted Plate Region

2. Character Segmentation

After number plate extraction character segmentation is occurred. Characters are segmented from the number plate image which is then used for template matching.Fig.2 shows the character segmentation of captured image.

3. Template Matching

Segmented characters are template matched with the templates of each character and the number plate is identified as a string.Fig.3&Fig.4 shows the output of string form and output after template matching respectively.

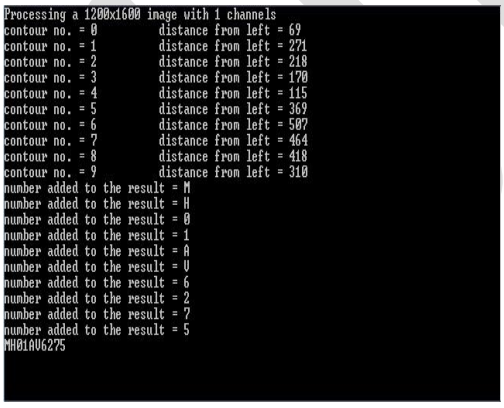

Fig.3: output after string form

Fig.4: output after Template Matching

SECTION-II

A) PROPOSED SYSTEM

i) Image Capture and Resizing

The first phase of the process is to capture the images of the moving vehicles for which number plate is to be recognized [1],[18]-[22]. The captured image is then normalized to a standard size. After that image is converted to grayscale image. Then localize the number plate from the captured image. Further processes are done on the localized number plate.

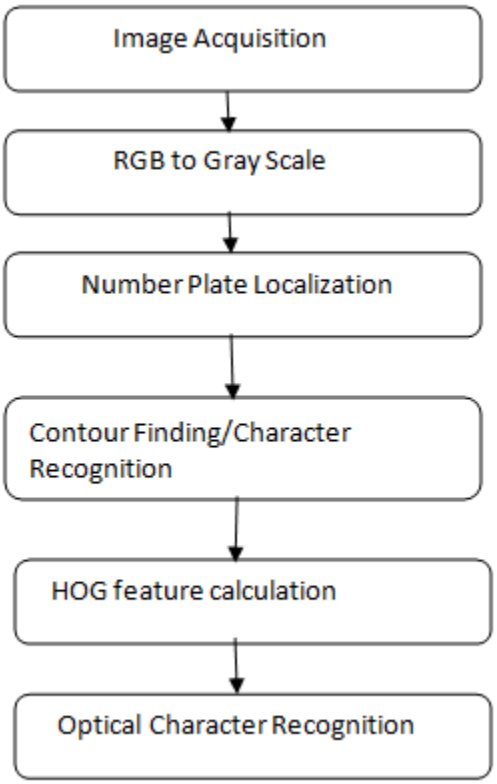

Fig. 5 Block Diagram for the Proposed Algorithm

B) TRAINING

Image sets of 26 alphabets and 10 numbers of different sizes and shapes are created. All these binary images are then used for the training phase. During training, the Histogram of Gradient (HOG) features are calculated for all the images. Every image is also given a unique label which will be useful while classifying the alphanumeric character in the test image. The classification process is done using Support Vector Machine (SVM) classifier.

C) TESTING

Proper image pre-processing techniques like converting to grayscale and adaptivehistogram equalization are done to get a binary version of the test image. Connected component analysis is done on the binary image and filtered using height and width to get the alpha numeric characters in the image. Then HOG features are found for each character and it is classified using the SVM classifier to check if it belongs to the dataset we used while training. Once it passes the check, the image is cropped along the Y axis to get only the region where the number plate is present.

After converting the cropped image to binary, horizontal histogram is calculated. This histogram gives information about the plate location in the cropped image. After locating the plate in the image, again thresholding, histogram equalization is done on this image (which contains only the number plate), and subsequently connected component analysis is done and the characters are filtered using height and width. Then each valid character is then identified using Optical Character Recognition (OCR) and the final vehicle plate characters are shown as the output.

SECTION-III

A) EXPERIMENTAL RESULTS

Fig. 6 shows the captured image from the moving vehicle to perform the experiment upon.

Fig 6. Image Acquisition

Fig7. Pre-Processed Image after Plate Localization

Fig. 7 depicts the pre-processed image of the number plate after its localization i.e. extraction of number plate from the input image.

Fig8. Image filtered using Height and Width

In fig. 8 the localized number plate image has been filtered using height after applying histogram equalization on the binary image.

Fig. 9 Image Cropped along Y axis

The image is cropped along Y-axis in fig. 9 for the enlarged view of the characters.

Fig 10.Cropped Number Plate

The number plate is then cropped from the whole image to get a clear image of the characters from the whole number plate.

Fig.11 Processed Cropped Image

The cropped image is then processed further as shown in fig. 11 i.e. filtered using height and width.

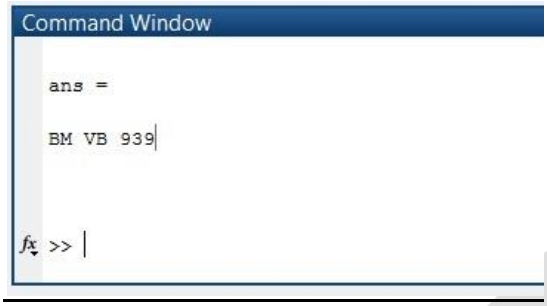

Fig12. OCR Output of the Characters

.

The outputs are shown in fig. 8 after complete process.

To measure the accuracy of the algorithm, it was tested over different images and models of the cars in different lighting conditions. The plate localization accuracy was found to be almost 100%, while the number plate recognition accuracy achieved was 99%.

Table 1: Accuracy Comparison Results

Methods	Plate Localization %	Character Recognition %
Hitesh Rajput [1]	97.6	96.4
M.-L. Wang and colleagues. [5]	99	98
K. Deb and colleagues[6]	92.4	-
Y.C. Chiou. [3]	96.2	-
Proposed Method	99.8	99

Table 1 shows the comparison between the proposed method and some recent approaches to vehicle number plate localization techniques. The results are measured in terms of accuracy.

SECTION-IV

A) CONCLUSION

A training based approach has been discussed in the paper for the vehicle plate recognition. The results of the proposed algorithm signify the superiority of the proposed algorithm over some common vehicle plate recognition approaches. For the extended work this can be taken to blurred and distorted number plates and try to recognize the plates clearly in some real bad weather conditions where input images are skewed.

REFERENCES:

[1]Hitesh Rajput et al., "An Automated Vehicle License Plate Recognition System," 0018- 9 162 / 15/$31 .00 © 2015 I E EE.

[2] G. Liu, Z. Ma, Z. Du, and C. Wen, "The calculation method of road travel time based on number plate recognition technology," in *Proc. Adv.Inform. Tech. Educ. Commun. Comput. Inform. Sci.*, vol. 201. 2011, pp.385–389.

[3]Y.-C. Chiou, L. W. Lan, C.-M. Tseng, and C.-C. Fan, "Optimal locations of number plate recognition to enhance the origin-destination matrix estimation," in *Proc. Eastern Asia Soc. Transp. Stu.*, vol. 8. 2011, pp. 1–14.

[4]S. Kranthi, K. Pranathi, and A. Srisaila, "Automatic number plate recognition," *Int. J. Adv. Tech.*, vol. 2, no. 3, pp. 408–422, 2011

[5] M.-L. Wang et al., "A Vehicle License Plate Recognition System Based on Spatial/Frequency Domain Filtering and Neural Networks," Proc. 2nd Int'l Conf. Computational Collective Intelligence: Technologies and Applications (ICCI 10), LNCS 6423, Springer, 2010, pp. 63–70.

[6] K. Deb, H.-U. Chae, and K.-H. Jo, "Vehicle License Plate Detection Method Based on Sliding Concentric Windows and Histogram," J. Computing, vol. 4, no. 8, 2009, pp. 771–777.

[7] C.N.E. Anagnostopoulos et al., "A License Plate-Recognition Algorithm for Intelligent Transportation System Applications," IEEE Trans. Intelligent Transportation Systems, vol. 7, no. 3, 2006, pp. 377–392.

[8] C.A. Rahman, W. Badawy, and A. Radmanesh, "A Real-Time Vehicle's License Plate Recognition System," Proc. IEEE Conf. Advanced Video andSignal Based Surveillance (IVSS 03), 2003, pp. 163–166.

[9] S. Wang and H. Lee, "Detection and recognition of number plate characters with different appearances," in *Proc. Int. Conf. Intell. Transp.Syst.*, vol. 2. 2003, pp. 979–984.

[10] M. M. I. Chacon and S. A. Zimmerman, "License plate location based on a dynamic PCNN scheme," in *Proc. Int. Joint Conf. Neural Netw.*, vol. 2. 2003, pp. 1195–1200

[11] L. Xiaojing, Research on Automatic Recognition of Car License Plate, Journal of Nanjing University of Aeronautics andAstronautics 30 (5), 573-576, 1998.

[12]Cho. D.U. and Cho. Y. H., "Implementation of preprocessing independent of environment and recognition of car number plate using histogram and template matching". The Journal of the Korean Institute of Communication Sciences, 23(1):94-100, 1998.

[13] Christoph Busch, Ralf Doner, Christian Freytag and Heike Ziegler, "Feature based Recognition of Traffic Video Streams for online Route Tracing", VTC'98. IEEE International Symposium on, 1998, pp.: 1790 –1794.

[14]Cui. Y. and Huang. Q, "Automatic license extraction from moving vehicles". International Conference on Image Processing(ICIP97), 3:126–129, 1997.

[15]Draghici, Sorin. "A neural network based artificial vision system for licence plate recognition",1997.

[16] Draghici. S, "A Neural Network based Artificial Vision System for License Plate Recognition", Int.J.Neural Syst., Vol.8 No.1 Feb.1997, pp.113-126.

[17]H. J. Kang and J. Kim, "Probabilistic framework for combining multiple classifier at abstract level," in *Proc. Int. Conf. DocumentAnal. Recognit.*, vol. 1. 1997, pp. 870–874.

[18] V. Kamat and S. Ganesan, "An Efficient Implementation of the Hough Transform for Detecting Vehicle License Plates Using DSP's, Cellular Neural Networks and Their Applications," Proc. IEEE Int'l Carnahan Conf., 1997, pp. 209–218.

[19] M. N. Granieri, F. Stabile, and P. Comelli, Recognition of Motor Vehicle License Plates in Rear-view Images, In: Jorge L. C. Sanz (Ed.), Image Technology, Advances in ImageProcessing, Multimedia and Machine Vision, Springer-Verlag, Berlin, pp. 231-252, 1996.

[20] V. Kamat and S. Ganesan, "An efficient implementation of the Hough transform for detecting vehicle license plates using DSPs," in Proc Real-Time Tech. Applicat. Symp., 1995, pp. 58–59.

[21]Comelli.P, Ferragina.P, Granieri. M.N., and Stabile. F, "Optical recognition of motor vehicle license plates", IEEE Trans. Veh. Technol., Vol.44, No.4 1995, pp.790-799 .

[22] K. Miyamoto, K. Nagano, M. Tamagawa, I. Fujita, and M. Yamamoto, "Vehicle number-plate recognition by image analysis," in *Proc. Int.Conf. Ind. Electron. Control Instrum.*, vol. 3. 1991, pp. 1734–1738.