Comparative Study on Effective Approaches of Automatic Number Plate Recognition

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Abstract: Programmed distinguishing proof of vehicle turns out to be more functional in numerous applications with the quick improvement of an open transportation system. The system consequently recognizes a vehicle by perusing the number plate information from a picture or a video. The Automatic number plate recognition system is utilized to distinguish the number plate under different perilous conditions like stormy, foggy climate impacts, low differentiation situations, objects like the number plate out of sight, and on a level plane tilted number plate. Diverse image processing methodologies, strategies, and calculations are utilized to construct programmed number plate recognition system technique to identify a number plate range from a picture or a video.

Keywords: Number plate, character recognition, number plate identification, image processing, classification, Template matching.

I. INTRODUCTION

The ANPR (Automatic Number Plate Recognition) expect a key part in various systems like development checking, Crime distinguishing proof, stolen vehicle disclosure and so on. Along these lines, ANPR is used by the city development office to screen the action and furthermore to track the stolen vehicle. In spite of the way that ANPR is an outstandingly old research area in an image taking care of yet in the meantime it is a creating well ordered, since perceiving the number plate from the image or from the video isn't that straightforward task as like checking the vehicle from a stream of an video. So far a substantial number of the researchers went on their own particular count to perceive the number plate, yet every strategy has a couple of confinements. For a couple of images it works properly, and for a couple of pictures, it isn't working suitably. That is the reason this framework is so far creating and still defective. Recognizing the number plate is the trying endeavour as the number plate forming style is changing from country to country. In the event that there ought to emerge an event of India the number plate creating style changes from state to state. In India the number plate is particular for bicycles and four wheelers. For four-wheelers the number plate's are also special, i.e. yellow for vacationer and white for private cars. These are the basic challenges recall before executing the ANPR framework. The automatic number plate recognition system consists several steps to recognize the numbers in the vehicle plate. Initial step in the plate recognition is pre-processing.

II. PRE-PROCESSING FOR CHARACTER RECOGNITION

Pre- processing is the initial method in the number plate localization. To recognize character regions from a number plate pre-processing is need to be done. Prior to the License Plate Detection (LPD) stage; a couple of pre-handling strategies must be performed to improve the idea of images, to remove the shadows and to empty clamor in the image. Pre-processing with organize is a manual for improve the LPD rate. A few pre-handling calculations that have been experienced while exploring the LPR frameworks are talked about in this area. The fundamental point of pre-handling is to enhance the complexity of the input image, to reduce the noise in the picture, henceforth to improve the preparing speed. In the pre- handling RGB picture is changed over into a binary picture. Different channels are utilized to expel commotion from the info picture. The information picture is improved by applying Gabor separating method expels the commotion.

RGB to Gray Scale Conversion:
The capture input image is RGB organize. The initial step of pre-processing is to change over RGB picture into dark scale picture. The essential motivation behind applying is to decrease the quantity of hues. The R, G and B parts are isolated from 24-bit shading estimation of every pixel (i, j) and 8-bit dark value is figured.

A. Automatic Detection of License Plate
Hitesh Rajput, Tanmoy Som and Soumitra Kar [1] they captured the images of the vehicle and normalized it to a standard dimension of 400×300 pixels. Then the RGB image is converted into a grayscale image. To compute the
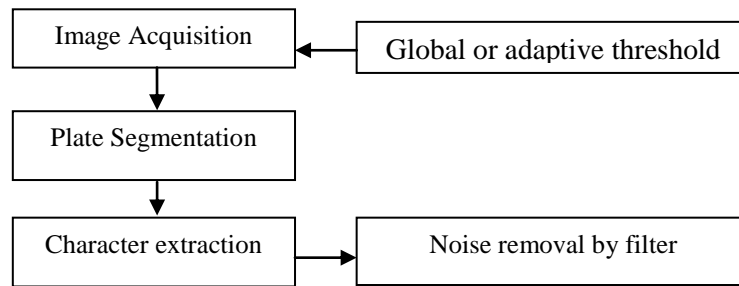
Fig 1: Number plate recognition

III. COMPARATIVE STUDY

approximation and details coefficient matrices wavelet decomposition is performed. The frequency energy is used to fine the number plate region. The number plate has both frequency ranges in horizontal and vertical axis. The plate has a high frequency, in order to find the vertical location plot of the number plate intensity's energy curve of the vertical frequency for each row is to be plotted. Similarly, for horizontal location plot is plotted by using intensity's energy curve. They used Gaussian filter to modify the input with a Gaussian function. Gaussian has many advantages like the rotational symmetric property. In order to match the segmented characters with the data base available is done by template matching. To differentiate the factors between the known images and unknown images a statistical correlation based method which gives highest correlation result which shows the best match of images is used

B. Plate Locating In Multi-Lane Which Has Complex Background

Jingyu Dun and Sanyuan Zhang, Xiuzi Ye, Yin Zhang [2] used an algorithm to locate the most common blue and yellow region in the Chinese number plates. Initial process is marking the yellow and blue regions in the number plate. To extract the candidate plate regions two rounds of scan need to be done. The concomitant color regions are found in the first step of scan. The number of the color transitions is found in the second step of scanning process. To merge the discrete segments the color concomitant property is used. The final color information is to locate the accurate location of the number plate and further it also removes fake plates. The image which has the drastic changes in the intensity, abnormal images it uses the adaptive block threshold to convert binary images. This reserves more useful points but it takes long time to process. For normal images global Otsu method works well. In the normal images the background is not uniform so there is no need of adaptive threshold method. Now use the coarse location as result. By using this coarse location to enlarge and enhance the difference between the white and blue colour. To identify the plate characters verification need to be done. In Chinese number plate's character size is related with width of the stroke. In order to eliminate false plates stroke width filter is used.

C. Number Plate Detection Under Various Weather Conditions

SamiulAzam, MdMonirul Islam [3] used an number plate detection process with five stages: Converting colour image into grayscale, Eliminate the effect of noise and rain, Binarization, Cropping connected components (CCC) and Enhancing the contrast, Angle correction. May the number plate in a car affect by contrast issues because of various weather conditions like dim light condition, blurred image. It decreases the performance f the detection process. Image which has low visibility due to fog is enhanced by Tamura and CLAHE method. The initial recognition is done by a new binarization method which uses the local irregularities as a basic feature. It identifies the intensity changes in the gray scale image in the form of high density white pixels. To fill the small holes Local counting filter that preserves high dense white areas is used. Prior to the cropping connected components (CCC) small thin white areas, regions other than the number plate, Low connectivities between white pixels have to be removed. This is done by morphological operations such as erosion and dilation using a disk structure element. The radius of the disk depends on the size of the number plate region. By using the cropped image it detects the tilt angle. Intensity information is not needed for tilt angle detection. But the information about the boundary or edge is sufficient. For that it uses Bersen binarization with empirical value of local window on the number plate image.

D. Number Plate Detection Using Colour Features

AmirHossein Ashtari, Md. Jan Nordin, and Mahmood Fathy [4] used the colour features in order to detect the number plate region of Iranian number plates. They optimized template matching algorithm for the detection. This algorithm sweeps the image surface to detect the information by using description or template. To represent real world colours it correlates one channel with another channel. The color and purity is indicated by Hue and Saturation. Vertical or slope search is used to find the aspect ratio of the number plate region. This search gives the information about the length and direction of the number plate. The next process is classifying and recognizing the number plate characters that are

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numbers and letters. The SVM (Support Vector Machine) classifier with a polynomial kernel of fifth degree homogeneous strategy. Decision tree with 28 features groups the characters of the number plate before applying SVM. If the result of this process is not reliable then the small group characters are passed through SVM. To convert the number plate image into binary image threshold value need to be set. If the threshold value is not correct then it causes discontinuity in the characters of the number plate. So a trade-off threshold value is important. To find the trade-off threshold value entropies by histogram and the probability of distribution between the background and foreground objects is used. According to the input image size the template image size is varied. If there is any noisy dots and surplus present in the binary image that leads incorrect detection of number plate.

E. Detection of Number Plate Region For Fast Moving Vehicles

Qingbo Lu, Wengang Zhou, Lu Fang, and Houqiang Li [5] proposed the detection of number plate region for fast moving vehicles by using kernel estimation. The speed of the vehicle causes the blurred snapshot which has low exposure time. It depends upon the illumination levels. By using the true angle of the blur kernel can be identified. The linear kernel is affected by the power spectrum of the blurred image due to fast motion. Radon transform is used to remove the effect of the noise in the blurred image after estimating the length in frequency domain. It estimates the kernel and it is used to find the final result of deblurring image with the simple NBID algorithm. This problem can be reduced by parameter estimation. This algorithm uses the property of the uniform blur kernel's spectrum which is a sic-like function differs from the normal input image. If the deblurring image is not uniform then the estimation of kernel is difficult since it has many degrees of freedom. So it is done by the projection transform. The relation between the angle of kernel and sparse coefficients estimates the angle. In the Fourier domain the power spectrum is affected by the length of the kernel. If the vehicle is moving very fat and the exposure time is very low then it is linear motion and it has constant speed

F. Efficient Approach Of License Plate Detection

Yule Yuan, Wenbin Zou, Yong Zhao, Xinan Wang, Xuefeng Hu, and Nikos Komodakis [6] present an efficient and robust method of number plate detection. They used downscaling method for detection which reduces the image size without affecting the original image.. Adaptive thresholding and novel density filter is used for detecting the edges and binarization of edges. For enhancing the edge density it uses the sobel operator. License plates generally have a high edge density. The orientation of characters in the number plate is horizontal and each character has same height. To remove the regions which is not an number plate region Connected component labelling (CCL) is used. A quantization method which represents the color feature is needed in order to reduce the illuminative variations in the number plate.

G. Number Plate Detection Based On Extremal Regions

Chao Gou, KunfengWang, Yanjie Yao, and Zhengxi Li [7] they proposed an method of number plate detection based on character-specific Extremal Regions (ERs) and hybrid discriminative restricted Boltzmann machines (HDRBM). The initial pre-process of input image is done by top hat transform in order to restrain the background noises. Then sobel operator is used to detect the vertical edges and removes curves in the background. The blank space between the two vertical lines is removed by some morphological operations. Geometrical validation filters the number plate by using various rectangular regions. Real AdaBoost classifier with decision trees found the character-specific ERs. In standard plates the geometrical attributes are used to segment the characters in the number plate. The histogram of oriented gradients is extracted from the image. Off-line trained classifier based on HDRBM recognizes each character in the number plate. Top-hat transformation is a non-linear filter. For various environment conditions the binary method with global threshold cannot produces the better result because the distribution of brightness. In light of that, the adaptive local binary method is applied.

Table 1 Comparison of literature survey

No	Methodology	Advantage	Disadvantage
1.	Automatic detection of license plate [1]	Efficient in varying conditions	Fails on multiple color plate
2.	Plate locating in multi-lane which has complex background [2]	Fake license plates can be located	Can't detect the plate which has change in color due to mud.
3.	Number plate detection under various weather conditions [3]	Can be applied for various hazardous conditions	Image has small noise doesn't have dominant direction which can't be detected
4.	Number plate detection using colour features [4]	Has proven to be practical	Can't detect the number plate information for various weather conditions

5.	Detection of number plate region for fast moving vehicles [5]	Can detect the number plate which has motion blur	Obvious artefact in the deblurred results
6.	Efficient approach of license plate detection [6]	Very fast	Limitation in difficult scenes
7.	Number plate detection based on extremal regions [7]	Can detect the plate under various light conditions.	Extraction of ERs is time-consuming

IV. CONCLUSIEON

In this Comparative study, various number plate detection methods are discussed. All of the methods have some common processes like pre-processing, character segmentation, character recognition and filtering. For pre-processing a image many method uses thresholding which converts the input image into binary image and also removes noise and curves. Various classifiers are used to extract the characters in the number plate region. Binarization extracts the region of candidate image. All the method of detection has some defects and also has some advantages.

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REFERENCES

[1] Hitesh Rajput , Tanmoy Som and Soumitra Kar, "An Automated Vehicle License Plate Recognition System" in The IEEE computer society,2015,pp 56-61
[2] Jingyu Dun and Sanyuan Zhang, Xiuzi Ye, Yi Zhang, "Chinese License Plate Localization in Multi-Lane with Complex Background Based on Concomitant Colors" in IEEE Intelligent transportation systems magazine, 2015, pp 52-61
[3] Samiul Azam ,Md Monirul Islam, "Automatic license plate detection in hazardous condition" in Elsevier Inc,2015, pp 172-186
[4] AmirHossein Ashtari, Md. Jan Nordin, an Mahmood Fathy, "An Iranian License Plate Recognition System Based on Color Features" in IEEE transactions on intelligent transportation systems, vol. 15, no. 4, august 2014
[5] Qingbo Lu, Wengang Zhou, Lu Fang, and Houqian Li." Robust Blur Kernel Estimation for License Plate Images from Fast Moving Vehicles" in IEEE transactions on image processing
[6] Yule Yuan, Wenbin Zou, Yong   Zhao, Xinan Wang, Xuefeng Hu, and Nikos Komodakis," A Robust and Efficient Approach to License Plate Detection" in IEEE transactions on image processing, 2015 pp 1-13
[7] Chao Gou, KunfengWang, Yanjie Yao, and Zhengxi Li, "Vehicle License Plate Recognition Based on Extremal Regions and Restricted Boltzmann Machines" in IEEE transactions on intelligent transportation systems, vol. 17, no. 4, APRIL 2016,pp 1096-1106
[8] Bhavin A Patel and Ashish Singhadia, "Review on Automatic   Number Plate Recognition System Using Improved Segmentation Method" in International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 9, September 2014
[9] Rajesh Kannan Megalingam, Prasanth Krishna, Pratheesh Somarajan, Vishnu A Pillai, Reswan Ul Hakkim, "Extraction of License Plate Region in Automatic License Plate Recognition", in IEEE, 2010
[10] Tran Duc Duan, Tran Le Hong Du, Tran Vinh Phuoc, Nguyen Viet Hoan, "Building Automatic Vehicle License-Plate Recognition System" Int. Conf. in Compute. Sci. RIVF, pp. 59-63-,2005
[11] J. Tian, R. Wang, G. Wang, and F. Yang. "A new algorithm for license plate localization in open environment using color pair and stroke width features of character", In Proc. Int. Symposium on Multispectral Image Process. and Pattern Recognit., pp.892117, (2013).
[12] J. Dun, S. Zhang, X. Ye, and Y. Zhang, "Chinese license plate localization in multi-lane with complex background based on concomitant colors," IEEE Intell. Transp. Syst. Mag., vol. 7, no. 3, pp. 51–61, Fall 2015.
[13] V. Abolghasemi and A. Ahmadyfard, "An edge-based color-aided method for license plate detection," Image Vis. Comput., vol. 27, no. 8, pp. 1134–1142, Jul. 2009
[14] J.Jiao, Q.Ye, and Q. Huang, "A configurable method for multi-style license plate recognition," Pattern Recognit., vol. 42, no. 3, pp. 358–369, Mar. 2009.
[15] 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 LNCS 6423, Springer, 2010, pp.63–70
[16] W. Zhou, M. Yang, H. Li, X. Wang, Y. Lin, and Q. Tian, "Towards codebook-free: Scalable cascaded hashing for mobile image search," IEEE Transactions on Multimedia (TMM), vol. 16, no. 3, 2014. pp. 601–611,
[17] J.-K. Chang, Seungteak Ryoo, Heuiseok Lim, "Real-time vehicle tracking mechanism with license plate recognition from road images", in Springer, J Supercomput 2013 pp 353–364
[18] M. S. Sarfraz , A. Shahzad, Muhammad A. Elahi , M. Fraz,I. Zafar , E. A. Edirisinghe, "Real-time automatic license plate recognition for CCTV forensic applications" in Springer Real-Time Image Proc 2013, pp: 285–295
[19] Mostafa Ayoubi Mobarhan, Asadollah Shahbahrami, Saman Parva, Mina Naghash Asadi, and Atefeh Ahmadnya Khajekini, "A License Plate Detection Algorithm Using Edge Features" in Advances in Computer Science, Eng. & Appl, Springer-Verlag Berlin Heidelberg 2012, pp. 413–421.
[20] E.K.Vellingiriraj, P.Balasubramanie, "A Novel Approach for   Recognition of Tamil Characters in Vehicle Number Plate based on Region Pixel through Surveillance Camera" in International Journal of Emerging Science and Engineering (IJESE) ISSN: 2319–6378, Volume-1, Issue-10, August 2013
[21] Md. Mahbubul Alam Joarder, Khaled Mahmud, Tasnuva   Ahmed, Mohsina Kawser, and Bulbul Ahamed, "Bangla automatic number plate recognition system using artificial neural network" in Asian Transactions on Science & Technology Volume 02 Issue 01

[22] W.Devapriya, C.Nelson kennedy babu, T.Srihari, "Indian license plate detection and recognition using morphological operation and template matching" in World Academy of Science, Engineering and Technology International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:9, No:4, 2015.

[23] Guixiang Liu, Zhongyou Ma, Zhongguo Du, and Can Wen, "The Calculation Method of Road Travel Time Based on License Plate Recognition Technology" in Springer CSE 2011, Part I, CCIS 201, pp. 385–389, 2011

[24] Seetharam S, Suresh Kumar M, Sai Saravana Harish R, Manikandan T, "Registration Plate Recognition System" in International Journal of Scientific Engineering and Research (IJSER), ISSN (Online): 2347-3878 Volume 2 Issue 3, March 2014

[25] Ying Wen, Yue Lu, Jingqi Yan, Zhenyu Zhou, Karen M. von Deneen, and Pengfei Shi, "An Algorithm for License Plate Recognition Applied to Intelligent Transportation System" in IEEE transactions on intelligent transportation systems, vol. 12, no. 3, September 2011

[26] V. Lakshmi Priya, K. Perumal, "Detecting the Car Number Plate Using Segmentation" in International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 3 Issue 10 October, 2014 Page No.8823-8829