

A Hybrid Technique for Automatic Number Plate Recognition Using Wavelet Transform and RBF Network

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Abstract— In the current years, Intelligent Transportation System (ITS) has a strong impact in people life as their capacity is to get better transportation protection and mobility and to enhance productivity through the use of advanced technologies. It is made up of 16 types of technology based systems. The License Plate Recognition System (LPRS) is a vital piece of the Intelligent Transportation System (ITS) and demonstrates its application. ITS has turned into a principal part of the Transportation Industry nowadays and it comprises of License Plate Recognition (LPR) System. License Plate Recognition (LPR) is likewise called Car Plate Recognition (CPR) or Automatic Number Plate Recognition (ANPR) System. In LPR System, once a vehicle ventures over attractive circle indicator it detects vehicle and captures image of the tag of the vehicle zone, following picture preprocessing tasks for development in the nature of vehicle picture. From this enhanced picture, tag district is perceived and removed. Tag acknowledgment or LPR is an innovation arrangement that takes captured images and changes over these images in content. It is mostly in view of Optical Character Recognition (OCR).

List Terms—ITS, LPRS, Car Plate Recognition, ANPR, Optical Character Recognition.

I. INTRODUCTION

A number plate is the unique identification of a vehicle. ANPR is expected to discover and perceive the number plate of a moving vehicle consequently. The Fundamental issues in number plate acknowledgment are high precision and high acknowledgment speed. SVMs have noteworthy potential for grouping. Disregarding the way that SVM based number plate acknowledgment [1] has achieved higher acknowledgment precision, it doesn't work outstandingly still under a couple of circumstances. India (email: er.subinps@gmail.com). can't be perceived because of extremely poor light, movement blurred impact, fade characters et cetera. Besides, every one of the techniques previously mentioned performed license plate recognition after characters had been fragmented. Be that as it may, images taken progressively might be troublesome for character division because of poor image quality. So as to enhance the recognition system execution, we propose another SVM-based multiclass classifier to perceive number plates with low quality [2].

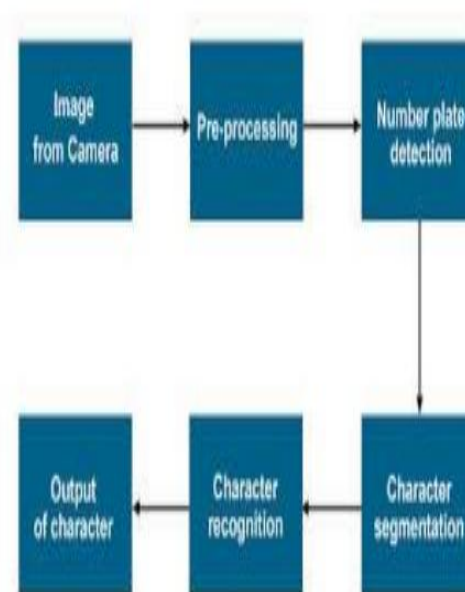


Fig.1 Automatic Number Plate Recognition Process

II. NUMBER PLATE DETECTION

A large portion of the number plate detection algorithms fall in excess of one classification in view of various procedures.

- 1) **Plate location:** a plate can be located anywhere in the vehicle.
- 2) **Plate background:** A plate can have different background colors based on vehicle type. For instance an government vehicle number plate may have unexpected foundation in comparison to other public vehicles.
- 3) **Screw:** A plate may have screw and that could be considered as a character. A number plate can be removed by utilizing image segmentation technique. There are various image segmentation strategies accessible in different literary works. In the vast majority of the strategies image binarization is

utilized. A few creators utilize Otsu's technique for image binarization to change over color image to gray scale image [3]. In the accompanying segments basic number plate extraction strategies are clarified, which is trailed by point by point exchange of image segmentation systems received in different literature of ANPR or LPR.

- a) In this technique, certain limit is characterized sure pixels as black and certain pixels as white. Be that as it may, the primary issue is the means by which to pick revise edge an incentive for specific image. In some cases it turns out to be exceptionally troublesome or difficult to optimal threshold value. Adaptive Thresholding can be utilized to defeat this issue. An threshold can be chosen by client physically or it can be chosen by a calculation consequently which is known as programmed thresholding [3].
- b) Edge detection Edge detection is central strategy for highlight recognition or feature extraction. By and large case the aftereffect of applying edge detection of calculation is a protest limit with connected curves. It turns out to be extremely hard to apply this technique to complex images as it may come about with protest limit with not associated bends. Diverse edge discovery calculation/administrators, for example, Canny, Canny-Deriche, Differential, Sobel, Prewitt and Roberts Cross are utilized for edge detection.
- c) Hough Transform It is an element extraction procedure at first utilized for line detection. Later on it has been reached out to discover position of discretionary shape like circle or oval. The original algorithm was summed up by D.H. Ballard [4].
- d) Blob detection Blob detection is utilized to identify focuses or locales that vary in shine or color when contrasted with environment. The fundamental reason for utilizing this approach is to discover complimentary locales which are not distinguished by edge detection or corner detection calculations.
- e) Connected Component Analysis (CCA) CCA or blob extraction is a way to deal with interestingly mark subsets of associated segments in light of a given heuristic. It scans binary image and names pixel according to availability states of current pixel, for example, North-East, North, NorthWest and West of the present pixel (8-network). 4-network is utilized for just north and west neighbor of current pixel. The calculation gives better execution and it is extremely valuable for mechanized image analysis. This strategy can be utilized as a part of plate segmentation and additionally character segmentation [4].
- f) It is regularly appropriate to digital image however can be utilized as a part of other spatial structures moreover. At first it was created for handling twofold images and after that stretched out for preparing dim scale capacities and images.



Fig.2 Number Plate Detection

III. WAVELET TRANSFORM

Edge detection alludes to the route toward identifying and locating sharp discontinuities in a picture Edge detection acting a basic limit in PC vision and image analysis, and is a basic regulation in the image analysis and pattern recognition. Edges are the sudden change focuses in the image which are the basic highlights of the image. These unexpected minor departure from focuses give the area of the image shape that exhibits the basic element. The edge illustration of a image reduces the amount of information to be movement, and it keeps hold of basic data about the states of articles in the prospect. The explanation of a image is trouble-free to fuse into a substantial amount of detection algorithms utilized as a part of PC vision and other image preparing applications [5].

Wavelet transform is a portrayal of signals as far as essential capacities that are gotten by expanding and interpretation a fundamental wavelet work [6]. We can take a wavelet transform as an apparatus of low-pass and high-pass channels for edge detection. The wavelet transform has the properties of territory, multi resolution, pressure, clustering and perseverance. These properties are reasonable for most applications in picture preparing including edge detection. The wavelet transform has comparative properties to Fourier change as a numerical method for signal analysis, the fundamental contrast between both is that wavelets are confined in both time and frequency, though the standard Fourier change is just restricted in frequency. A signal can be deteriorated by a wavelet transform through of a progression of rudimentary capacities, made from enlargements and interpretations of a premise work Ψ , which is known as the mother wavelet.

IV. LITERATURE SURVEY

Yovan Felix et al. [2017] In the transport and traffic management system, tracking of vehicles on road is a prime importance vehicles are identified by reading their number plate, the existing system becomes complicated when there is a large number of vehicles being traced at different locations and therefore automatic license plate recognition ALPR is used to extract the contents of the number plate. The image can be fetched by using CCTV cameras with an MATLAB image processing tool. Besides these can be used for a surveillance purpose to facilitate the operations at the toll of many gated

communities the identification of vehicles are done through vehicles through movement finding the license plate and precisely recognizing the numbers in the license plate. Here we are going to use Adaptive Histogram Equalization AHE, Active contour method for region separation Optical Character Recognition OCR to recognize the characters and Deep Neural Network. DNN is used for classification and extracting the text as an alphanumeric characters and comparing the text with the predefined table created in MYSQL server and changing the status accordingly [7].

HILÁRIO SEIBEL et al. [2017] In this paper, our design and build up a novel, free and open-source structure supported by SR and automatic license-plate recognition (ALPR) strategies to license-plate characters in low-quality genuine traffic videos, caught by cameras not planned particularly for the ALPR undertaking, helping measurable investigators in understanding an occasion of premium. The structure handles the important conditions to distinguish an objective tag, utilizing a novel strategy to find, track, adjust, super-resolve, and perceive its alphanumerics. The user gets as yields the amended and super settled tag, wealthier in detail, and furthermore the arrangement of tags characters that have been consequently perceived in the super-resolved image. Furthermore, we additionally outline and build up a novel SR strategy that activities the tags independently onto the corrected lattice, and after that fill in the missing pixels utilizing inpainting procedures [8].

Pakorn Watana chaturaporn et al. [2017] in this paper, the growth of economic influences city authorities to plan and build infrastructure. The growth prediction mostly uses modern mathematical models. The accuracy of the model is highly depended on reliable parameters. Two crucial parameters for most models are traffic capacity and average travel speed along road networks and obtained from an origin-destination (OD) estimation. Thus, an OD estimation is necessary to obtain reliable parameters for the predictive models. Traditionally, the OD estimation is performed by human observation; however, an automatic license plate recognition and matching algorithm show potential of obtaining such data. Additionally, the observation is able to perform long term observation which is impractical for human. Therefore, this paper reports an empirical experiment on OD estimation using automatic license plate matching along with a real-world human observation survey in Mukdahan province. The results from both types of surveys are reported and compared. The different results between the both raises an opportunity for researching an optimal method of OD estimation in Thailand [9].

Petr Hurtik et al. [2017] In this paper, by an car license plate recognition, we mean a software system preparing images and giving an alphanumeric interpretation of car plates incorporated into a picture. We transcription the undertaking into four sub- tasks: license plate localization, license plate extraction, characters division and characters acknowledgment. Each of the four sub- tasks are talked about with regards to standard methodologies and possess arrangement in view of a chain of standard and soft computing image processing

algorithms is exhibited. In this chain, the F- transform estimated pattern matching algorithm assumes the vital part. For the arrangement, we introduced acknowledgment capacity for a dataset which incorporates 500 pictures with troublesome conditions [10].

Safaa S. Omran et al. [2017] In this paper, License plate recognition (LPR) framework is a critical framework in our life. Separating between the three styles were finished relying upon the plate size. An optical character recognition (OCR) is utilized with relationship approach and formats coordinating for plate recognition by segmenting each number, character and word into sub images. The product utilized is MATLAB R2014a. The calculation is effectively built with test of images correctly identified [11].

V. PROPOSED METHODOLOGY

The proposed method for Indian number plate recognition works in two sections:

- (1) Pre-processing of number plate image and
- (2) Character recognition of number plate.

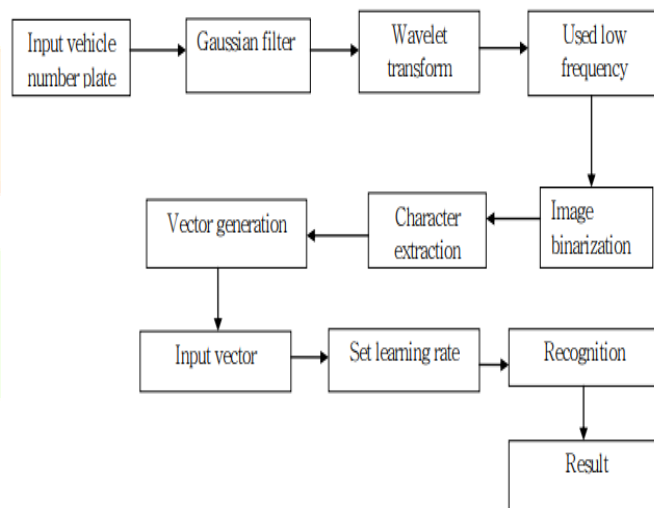


Fig.3 Basic working LPR model

Input image: - In this section number plate image is loaded as input. The type of image is any standard format.

Gaussian Filter: -It is category of low pass filter for removal of noise in input image.

Wavelet transform: - it is frequency based transform function used decomposition of image in different layers. The decomposed layers forms in details and approximate, the details part is reserved and approximate part process as feature matrix for creation of template.

Low frequency: - The process of transform value is only low frequency value high frequency value is preserved.

Image binary: - in that process image feature data is converted into binary formats used in the method of Otus.

Vector generation: - vector generation is the process of single input fashion of neural network

Input vector: - input vector is input neurons of RBF neural network.

Learning rate: - it is probability based parameter for the training of template.

Recognition: -It is point based method for template recognition.

There are three basic types of Indian number-plate , three main types Indian number-plates, which are: (a) black character, yellow background and black rectangular frame; (b) white character, blue background and white rectangular frame; (c) red or black character, white background and black rectangular frame. Each front-view number-plate consists of a character string including eight characters. Indian number-plate characters can be divided into four classes:(a) Indian characters, (b) letters, (c) digits, and (d) dot ("•"). Indian character is either province initial or army service initial (in there are thirty province and ten army service). The width and height of each character area are respectively 45cm and 90cm (except the radius of dot "•" is 5cm), and the interval between neighboring character areas is 12cm. here we draw the flow chart of number plate preprocessing.

In order to enable a computer with the ability to recognize characters, it must initially create those characters. The factor to consider when creating a matrix is the size that will be used. When it wants to use two different fonts, it may not be able to create those fonts. A matrix size of 3 x3 was created, through the steps as explained above. The network receives the 36 Boolean vector values as a 436-element input vector. It is then needed to spot the letter by responding with a 36-element output vector. The 36 elements of the output vector each represent a letter. To operate properly, the network should respond with a 1 in the position of the letter being presented to the network. Every single diverse incentive in the output vector ought to be 0. Also, the network ought to have the capacity to deal with noise In practice, the network does not receive a perfect Boolean vector as input.

The neural network desires 36 inputs and 26 neurons in its output layer to determine the letters. The network is a two-layer Gaussian kernel network. The Gaussian transfer work was picked in light of the fact that its yield go (0 to 1) is ideal for figuring out how to 43 output Boolean values. The hidden (first) layer has 22 neurons. This number was picked by figure and knowledge. If the network has hassle learning, then neurons can be added to current layer. The system is prepared to output a 1 in the right position of the output vector and to fill the rest of the piece of the output vector with 0's. Now and again the system not makes the ideal 1's and 0's thus because of uproarious info vectors. At the point when the system is prepared, the output is gone through the aggressive exchange work contend. This ensures the yield proportional to the letter most like the uproarious data vector goes up against an

estimation of 1, and all remaining have an estimation of 0. The output that is really utilized it aftereffect of the post-processing.

There are two arrangements of weights; input-hidden layer weights and shrouded output layer weights.

The memory of the neural network is shown by these weights, where final learning weights can be used when running the network. Beginning weights are created discretionarily from that point; weights are refreshed utilizing the error (contrast) between the real output of the network and the coveted (target) output. Weight updating happens at every iteration, and the network learns whereas iterating repeatedly till a net minimum error value is achieved. Initially we must define notion for the patterns to be keep Pattern p. a vector of 0/1 usually binary-valued. Additionally layers of weights might be included yet the additional layers can't receive Inputs touch base from the left and each approaching interconnection has a related weight, wji. The observation procedure unit plays out a weighted include at its input value.

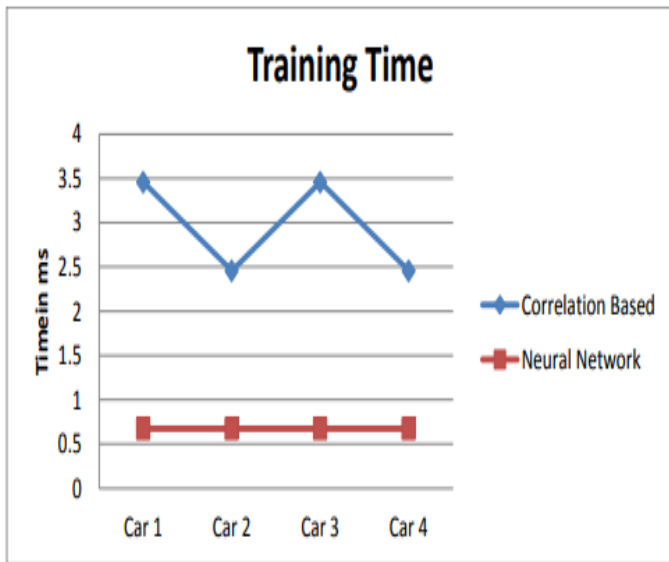
VI. RESULT ANALYSIS

In this we have analyze the performance of the License plate recognition framework utilizing Radial premise work Network. We endeavored to decrease the many-sided quality of the discovery and acknowledgment of the license plate. The result of this dissertation are based on the performance of the radial basis feed forward network. The recognition rate are reduced as we have seen the performance of the system improves comparing to the two neural network, back propagation network, Learning Vector Quantization Neural Network, Multiple threshold approach and etc.

For the assessment and execution estimation of proposed technique for number plate recognition, utilized distinctive arrangement of number plates. Here we are also comparing our proposed method to correlation method which is one of the efficient techniques for matching. Recognition time, training time and recognition rate are the key parameters of any automatic number plate recognition system. So here we are doing some comparative study which is shown by tabular and graph form.

Table-1 for Training Time

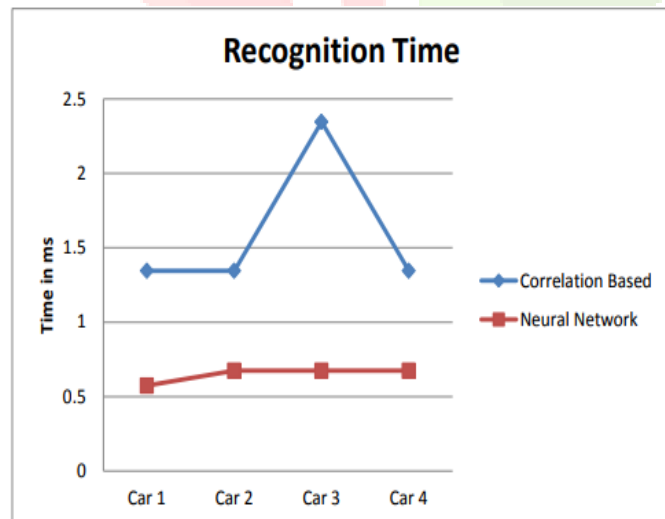
Training Time		
	Correlation Based	Neural Network
Car 1	3.4569	0.67554
Car 2	2.4569	0.67554
Car 3	3.4569	0.67554
Car 4	2.4569	0.67554



Graph-1 for Training Time

Table-2 for Recognition Time

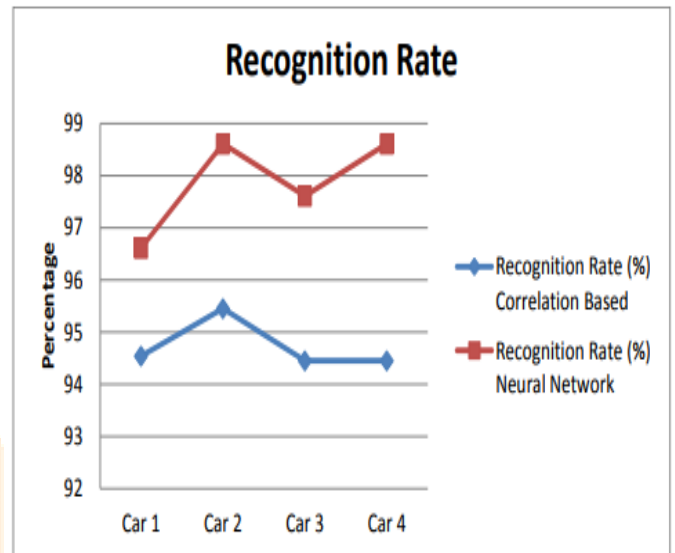
Training Time		
	Correlation Based	Neural Network
Car 1	1.3456	0.57386
Car 2	1.3456	0.67386
Car 3	2.3456	0.67386
Car 4	1.3456	0.67386



Graph-2 Recognition Time

Table-3 for Recognition Rate

Training Time		
	Correlation Based	Neural Network
Car 1	94.54	96.61
Car 2	95.45	98.61
Car 3	94.45	97.61
Car 4	94.45	98.61



Graph-3 for Recognition Rate

CONCLUSION

In this paper, we propose a license plate recognition method for the change of the recognition rate and recognition time for acknowledgment of the number and the character of the vehicle tag. We proposed another strategy of Neural Network for Vehicle license plate recognition. The Neural Network creates less recognition times and enhances the recognition time of the license recognition system. Our work shows better performance as compare to the correlation method which is one of the efficient techniques for matching. Therefore, the standard deviation error reduces which comes from the data lost during the preprocessing in the recognition process. In the future work direction of our research can be carried out for the different cases including the following specifications. We need to reduce the processing time i.e. if we take sampled car data set for the processing to recognize one car than to handle 1000 cars is difficult task. Pattern should be correctly segmented.

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