



Real Time ALPR for Vehicle Identification Using Neural Network

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Abstract—With the rapid growth in the number of vehicle, there is need to improve the existing systems for identification of vehicle. An (ALPR) –Automatic License Plate Recognition System that can identify vehicle is in demand in order to reduce the dependency on labour. This paper begins with a detection of license plates using various strategies. The system has many practical applications such as: parking accounting systems, traffic monitoring and security systems of many kinds. The results of this technique are given and then reviewed. Finally, possible extensions to make the algorithm more robust are discussed.

Keywords—Image Normalization, Image Extraction, Image Segmentation, Image Dilation, Image Crop, Neural Network etc.

I. INTRODUCTION

An Automatic License Plate Recognition (ALPR) System is one kind of an Intelligent Transport System and is of considerable interest because it has potential applications in highway electronic toll collection and traffic monitoring systems. This type of applications puts high demands on the reliability of an ALPR System.

The system, based on regular PC with video camera, catches video frames which include a visible car license plate and processes them. Once a license plate is detected, its digits are recognized, displayed on the User Interface or checked against a database.

This project will focus on the design of algorithms used for extracting the license plate from a single image, isolating the characters of the plate and identifying the individual characters.

II. RELATED WORK

In [14][19] major three steps are mentioned Localization of the plate, extraction of plate characters, recognition of characters using suitable identification method. [15] [12][13] There are basic three modules license plate location, character segmentation, character recognition. [9] License plate localization, segmentation and multilevel classification RBF neural network is used

for recognition. [2][3] Pre-processing is done to reduce noise considering different aspects, segmentation is done and feed forward neural network is used for recognition. [5][6] Basic three modules: extraction of plate region, segmentation of character and recognition of plate characters. [16] It has basic phases, vehicle image, finding plate region, segmenting the characters, feature extraction, recognition with ANN. [8] This paper consist of the OCR is manage by hybrid strategy, an probabilistic edit distance is proposed for providing an explicit video based approach, cognitive loop is introduced at critical stage of algorithm. [11] This paper is based on the improvement of traditional back propagation algorithm. [7] In this paper effective techniques for edge gradient and different binarization thresholds are studied. Paper [10] proves that result provides the better recognition accuracy than using traditional techniques for license plate recognition. In [17] image of number plate is captured and segmentation is done by horizontal and vertical projection, then feature extraction is done and that data is send to NN for recognition.

III . SYSTEM MODEL

A set of rules have been placed on our system, they are as follows:

1. License plates are rectangular white regions containing 4 alphabets and 6 digits as most Indian license plates do.
2. There is no motion blur in the captured image, namely, the vehicle's speed is very low.
3. The license plate is located at the bottom level of the vehicle.
4. The plates have a rectangular shape with two rows and character
5. The plate has dark characters on a bright with background.

The license plate recognition system can be classified into the following steps:

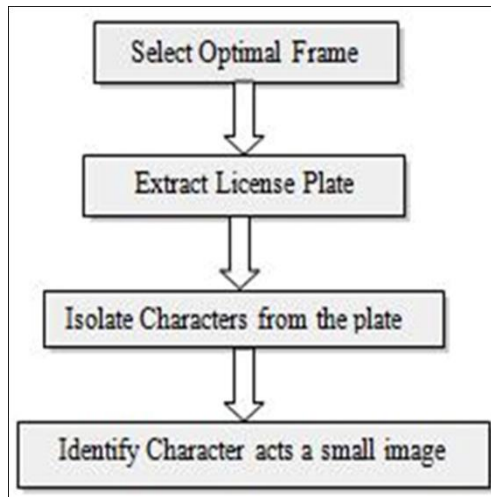


Figure 1: Block Diagram of the ALPR system

Thus we are dividing the steps of our algorithm in three parts

1. Extraction of License Plate
2. Segmenting Characters
3. Character Recognition using OCR engine

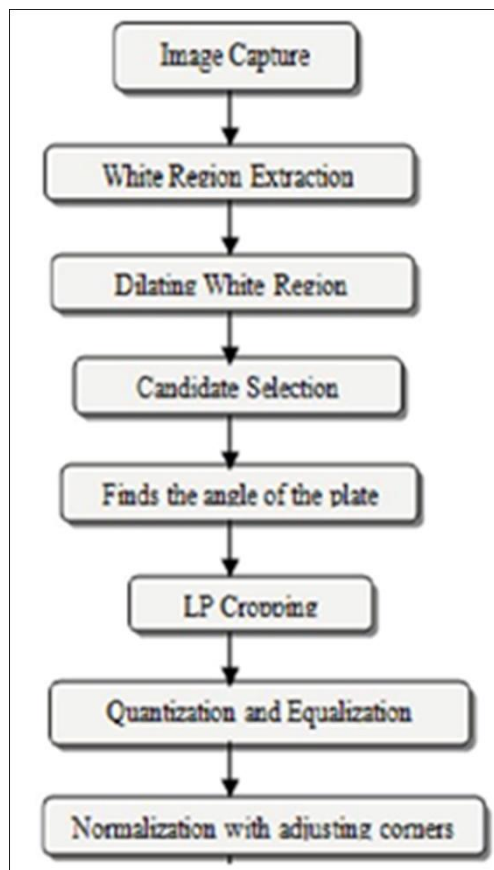


Figure 2 : License Plate Extraction

The most important principle in this part is to use conservative algorithms which as we get further becomes less conservative in order to, step by step, get closer to the license plate, and avoid losing information in it, i.e. cutting digits and so on.

i. White Region Extraction:

The frame containing a license plate, which returns the binary image in which only white pixels are used. For this purpose, we used CIE (Commission International de Eclairage) color system is used, because it appeared to be more accurate for white pixels identification than the RGB(Red Green and Blue) and HSV(Hue Saturation and Value) systems.



Figure 3: Example of a captured frame

1. Extraction of License Plate

The purpose of this part is to extract the License Plate from a captured image. The output of this module is the RGB picture of the LP precisely cropped from the captured image, and a binary image which contains the normalized.

ii. Dilating White Regions

Dilation is a type of transformation that changes the size of an image. The method dilates the white regions appearing on

This method generally allows identifying white regions. It ignores the holes inside the plate, then grouping white regions in separate filled components and highlight the separation between them which is very useful for the next step.



Figure 4: Captured frame with white regions filtered

iii. Fixing the License Plate Region Candidate Selection:

The method first separates the picture into connected components. Then, it processes the candidate selection algorithm, in which the deepest white regions satisfying the following conditions are selected:

- Area > LP_MIN_AREA
- LP_MIN_RATIO <= height/width <= LP_MAX_RATIO
- Area >= max(areas of the candidates)/3.5

LP_MIN_AREA, LP_MIN_RATIO, LP_MAX_RATIO, 3.5 are parameters which are selected after testing multiple images, and should be refined to get even more accurate results. If no candidates are found, then the method chooses the region with maximum area to be the LP region; otherwise, it chooses the candidate with maximum area. The method returns a rectangular area with safety spacing from the found area.



Figure 5: Fixing the License Plate Region

Generally, the license plate appears as a separate component. Moreover, license plates have characteristics like height, width, area etc which are common to all license plates. It permits to select the proper region in the frame of the plate.

iv. Determining the Angle of the Plate Using the Random Transform

The method determines the angle of the supplied picture relatively to the horizontal. It uses the Random transform in order to find lines on the picture, and returns the angle of the most visible one.

Generally, the license plate region contains parallel lines, with the same angle as the license plate one. Determining the angle of the plate permits to rotate it in order to avoid part of digits lost when cropping the plate.

v. Improved License Plate Region:

The method improves the license plate region as compared to the previous picture.



Figure 6: Improved LP Region

Some white components outside the license plate still appear and we need to get closer to the LP region in order to start the cropping process with the best conditions.

vi. LP Crop:

The method computes the sum of the lines and of the columns in the picture obtaining one vector for each

direction. For these two directions, it computes the first point respectively at the left and the right side of the vector which is superior or equal to the average of this vector, thus obtaining a rectangle to be used for cropping the LP. This function is used to crop the License Plate and returns the smaller image from the bigger image.



Figure 7 : Cropping of an image

noises at the border of the plate, thus obtaining a precise LP contour.

vii. LP Quantization and Equalization:

This is a very important step for a successful decryption of the LP. In order to perform the character recognition, we should be able to make the difference between digits and background inside the plate.



Figure 8: Quantized and equalized LP

Equalization and Quantization permit to obtain a gray scale image with improved contrast between digits and backgrounds, thus obtaining better performance for the binarization process which uses adaptive threshold. This is essential for the character recognition process.

viii. Normalized LP:

Transform the previous step of image into a rectangular matrix (by turning and stretching) whose normalized size is 50x150. The method also transforms the binary image into its complement.

As said before, there are Indian LPs of different sizes and we need to get a LP with standard size in order to recognize the LP digits in front of the digits which are in the neural network dataset.

ix. Adjusting Normalized LP Horizontal Contours:

The method determines the LP horizontal contours and removes vertical small noise from the picture. It first computes the sum of the lines in the supplied image; the graph is searched for a signal whose bandwidth is between MIN_HEIGHT = 26 and MAX_HEIGHT = 48, parameters which was previously statistically chosen.



Figure 9 : Normalized LP region

It is clear that we should obtain a better LP contour, for example the black line which is around the plate should

be removed, for the next steps to be more successful segmentation machine.

The image obtained at the precedent step is very close to the LP real contours. This step permits to eliminate local and the background which make the work easier for OCR machine.

2. SEGMENTATION

In order to segment the characters in the binary license plate image the method named peak-to-valley is used. The methods first segments the picture in digit images getting the two bounds of the each digit segment according to the statistical parameter For that purpose, it uses a recursive function which uses the graph of the sums of the columns in the LP binary image. This function passes over the graph from left to right, bottom-up, incrementing at each recursive step.

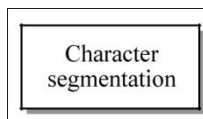


Figure 10: Character Segmentation

This function uses the segment function which keeps the result with largest area and finds the separation of the segment.

3.THE OCR ENGINE

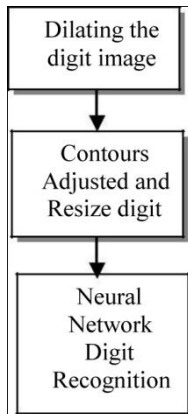


Figure 11: steps of OCR Engine

The OCR engine was designed as an inter-changeable plug-in module. This allows the user to choose an OCR engine which is suited to their particular application and to upgrade it easily in the future. At present, there are several versions of this OCR engine. One of them is based on a fully connected feed forward artificial neural network with sigmoidal activation functions. This network can be trained off-line with different training algorithms such as error back propagation.

a. Dilated Digit:

The method dilates the digit image obtained as the precedent step. By Dilating image, it permits to reduce noises due to poor image quality. It also exaggerates the digit width making a clear separation between the digit



Figure 12: The Dilated Digit

b. Contours adjusted and resized digit:

The method adjusts the LP contours for both in the horizontal and vertical directions. Then the digit is resized to standard dimensions, according to the neural network dataset (20x10).

It is clear that we should obtain a better digit contour for the OCR machine to be more successful. Moreover, the standard size of the digit image corresponds to the size of the pictures in the neural network dataset.

c. The Neural Network and the digit recognition algorithm:

Given the digit image obtained at the precedent step, this digit is compared to digits images in a dataset, and using the well-known Neural Network method, after interpolations, approximations and decisions algorithm, the OCR machine outputs the closest digit in the dataset to the digit image.

As known, neural network is a function from vector to vector, and consists of an interpolation to a desired function

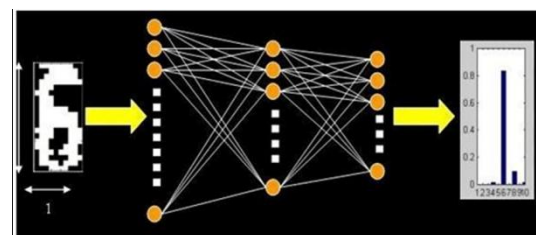


Figure 13: Neural Network Architecture

We use a trainable recognition engine based on a neural network. During the recognition phase, the system does not access this database but uses the information conveniently stored in a compact form in the weight state of the neural network.

Optical Character Recognition is extensively implemented using neural networks, which generally solves problems using different tools for Neural Networks which permits to concentrate on the digit images dataset only and this is very convenient.

IV. CONCLUSIONS

In this paper, we presented application software designed for the recognition of car license plate. Firstly we extracted the plate location, then we separated the plate characters individually by segmentation and finally applied template matching with the use of neural network. This system is designed for the identification Indian license plates and the system is tested over a large number of videos. Finally it is proved to be 97% for the extraction of plate region, 96% for the segmentation of the characters and 98% for the recognition unit accurate, giving the overall system performance 92.57 recognition rates. This system can be redesigned for multinational car license plates in future studies.

V. REFERENCES

- [1] R. Gonzalez, R. Woods. Digital Image Processing. New Jersey: Prentice-Hall, 2002.
- [2] M. Sonka, V. Hlavac, R. Boyle. Image Processing, Analysis, and Machine Vision. California: Brooks/Cole Publishing Inc, 1999.
- [3] S. Kim, D. Kim, Y. Ryu, G. Kim, A Robust License-Plate Extraction Method under Complex Image Conditions," Pattern Recognition, 2002. Proceedings, 16th International Conference on, Vol. 3
- [4] D. Gao; J. Zhou, Car license plates detection from complex scene," Signal Processing Proceedings, 2000. WCCC-ICSP 2000. 5th International Conference on, Vol.
- [5] M. Yu; Y. Kim, "An approach to Korean license plate recognition based on vertical edge matching ," Systems, Man, and Cybernetics, 2000 IEEE International Conference on, Vol. 4.
- [6] Y. Hasan, L. Karam, "Morphological Text Extraction from Images," IEEE Transactions on Image Processing, Vol. 9
- [7] Z. Lu, Detection of Text Regions From Digital Engineering Drawings," IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 20, No. 4, pp. 431;439, April 1998.
- [8] L. Fletcher, R. Kasturi, "A Robust Algorithm for Text String Separation from Mixed Text/Graphics Images," IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 10, No. 6, pp. 910;918, November, 1988.
- [9] Fernando Martín Rodríguez, Xulio Fernández Hermida, Automatic Reading Of Vehicle License Numbers
- [10] Halina Kwaśnicka And Bartosz Wawrzyniak, License Plate Localization And Recognition In Camera Pictures, Faculty Division Of Computer Science, Wrocław University Of Technology, Ai-Meth 2002 – Artificial Intelligence Methods November 13-15, 2002, Gliwice, Poland
- [11] Ali Tahir, Hafiz Adnan Habib, M. Fahad Khan. License Plate Recognition Algorithm For Pakistani License Plates
- [12]. Meng Sun , Wenzheng Li , and Haisheng Li, The Design of Develed BP Arithmetic and Its Application in the License Plate Recognition, (ISCSCT '09) Huangshan, P. R. China, 26-28,Dec. 2009, pp. 162-165
- [13] Mei-Sen-Pan, Jun-Biao-Yan, Zheng-Hong-Xiao, Vehicle License Plate Character Segmentation, International Journal Of Automation And Computing, October 2008

