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Vehicle License Plate Detection Using Morphological Processing and Heuristics

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Abstract
Automatic detection of car license plate in images has applicability in traffic surveillance parking lot management and tollgate management. Varying illumination, pose angles and different license plate designs and fonts are some of the challenges in license plate detection. In this paper a fast automatic method for license plate detection based on vertical edges is proposed. The method proposed in this project has higher accuracy and a lower computational complexity. In the case of the motion blurred images, the vertical edges are not detected clearly. To solve this problem Harris Corner Point Detection Algorithm is used as an additional heuristic based on the fact that the text characters present in License Plate have several Corner Points. This improves the overall accuracy of the method in identifying the license plate region.
Index Terms**—**Adaptive thresholding (AT), car-license-plate detection (CLPD), Sobel operator, vertical edge detection algorithm (VEDA).

I. INTRODUCTION

The car-license-plate (CLP) recognition system is an image processing technology used to identify vehicles by capturing their CLPs. The CLP recognition technology is known as automatic number-plate recognition, automatic vehicle identification, LP recognition, or on-line character recognition for cars. The CLP detection and recognition system (CLPDRS) became an important area of research due to its various applications, such as the toll gate management, traffic control, security services, parking control, airport or harbor cargo control,speed control, data collection, crime prevention and so on [1], [2]. Usually, a CLPDRS consists of three parts: license-plate (LP) detection (LPD), character segmentation, and on-line character recognition. Among these, LPD is one of the most important part in the system because it affects the system's accuracy [3]. There are many issues that should be resolved to create a successful and fast CLP detection system (CLPDS), e.g., poor image quality, sizes and designs of the plate, processing time, and complexity. The need for car identification is increasing for many reasons such as criminal activity, vehicle access highway control, and border control. To identify a car, features such as model, color, and LP number can be used [4]–[6].In vehicle scanning systems, cameras are used and installed in front of police cars to identify those vehicles. Usually, numerous vehicle scanning and prosecute systems use outstanding cameras [7], and this leads to cost increment of the system in both hardware and software. Since many methods have been proposed in various intelligent transportation system applications, the CLPDRS is usually based on an image acquired at 640 × 480 resolution [8]. An enhancement of CLPD method performance such as reduction of computation time and algorithm complexity, or even the build of the LP recognition system with lower cost of its hardware devices, will make it more practical and usable than before. This paper proposed a method for CLPD, in which a web camera with 352 × 288 resolution is used instead of a more sophisticated web camera. In this paper, the web camera is used to capture the images, and the process is performed to detect the plate from the whole scene image. Vertical edge extraction and detection is an important step in the CLPDRS because it affects the system's accuracy and computation time. Hence, a new vertical edge detection algorithm (VEDA) is proposed here to reduce the computation time of the whole CLPD method [9].

II. PROPOSED METHOD FOR VEHICLE LICENSE PLATE DETECTION

License plate (LP) detection is performed in a sequence of steps as shown below.

1. Gray scale image
2. Adaptive threshold
3. ULEA
4. VEDA

5. HDD
6. CRE
7. PRS
8. HARRIS CORNER POINT DETECTION

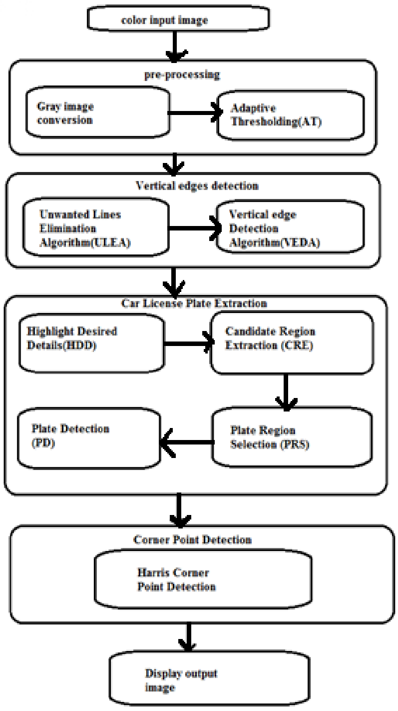

Fig 1: System Architecture

1.Gray scale image conversion:

The original color image is converted to the grayscale image.

2.Adaptive Thresholding Technique:

After the color input image is converted to grayscale, an AT process is applied to the gray scale image to get the binarised image.

The adaptive thresholding is just a simple extension (extra time). The pixel is related with an average of neighboring pixels. Specifically, an approximate moving average of the last *S* pixels seen is calculated while crossing the image. If the value of the current pixel is *T* percent lower than the average, then it is set to black; otherwise, it is set to white. This technique is useful because evaluating a pixel to the average of neighboring pixels will keep hard contrast lines and ignore soft inclined changes. The advantage of this technique is that only a single pass through the image is required.

3.ULEA (Unwanted Line Elimination Algorithm)

In the binarized image the unwanted lines are detected. To remove that lines the ULEA algorithm is used. Thresholding process in general produces many thin lines that do not belong to the LP region. There are many long foreground lines and short random noise edges beside the LP region. The unwanted lines are background edges and noise edges. These lines may interfere in the LP location. ULEA has been proposed to eliminate these lines. While processing a binary image, the background is the black pixel values, and the foreground is the white pixel values. A 3 × 3 mask is used throughout all image pixels.

4.VEDA (Vertical Edge Detection Algorithm) :

After eliminating the unwanted lines in the binary image the Vertical Edge Detection Algorithm (VEDA) is to distinguish the plate detail region, particularly the beginning and the end of each character. The idea of the VEDA concentrates on intersections of black – whitein fig 2.

Fig 2 Intersection of black-white and white-black region

The left side arrow shows that the black-white region and the right side arrow show the white-black-white region.

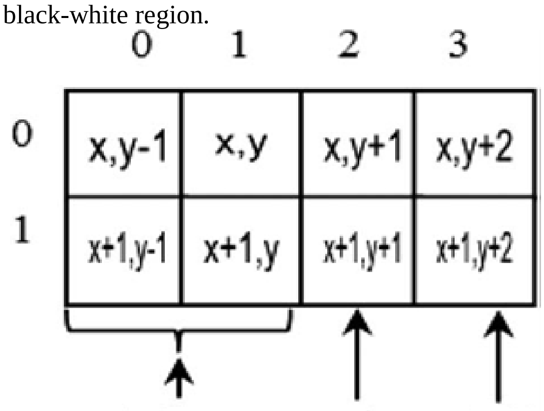

Fig 3 Design of the mask

Where x and y represents rows and coloumns of the image, respectively. Moving the mask from left to right, the black and white region will be found. The last two black pixels only be kept as usual. The proposed mask size is 2*4 to satisfied the following criteria.

1) In this type of a mask, it is divided into three sub masks.
   - The first sub mask is the left mask "2 ×2," the second sub mask is the centre "2 ×1," and the third sub mask is the right mask "2 ×1," as marked in Fig.2.
   - Simply, after each two pixels are checked at once, the first sub mask is related so that a 2 pixel width "because two column are

processed" can be considered for detecting. This process is specified to detect the vertical edges at the intersections of black–white regions.

- Similarly, the third sub mask is related on the intersections of white–black regions. Thus, the detected vertical edge has the property of a 1 pixel width.

2) The number "2" points out the number of rows that are verified at once. The consumed time in this case can be less twice in case each row is individually verified. To choose the column at locations (0, 1) and (1, 1) to be the centre of the proposed mask, two pixels and one pixel in the case of black–white and white–black regions are hold, respectively. This process is operated for both of the edges at the left and right sides of the object-of-interest. The first edge can have a black-pixel width of 2, and the second edge can have a black-pixel width of 1. The 2 ×4 mask starts off moving from top to bottom and from left to right.

5.HDD (Highlighted Desired Details):

After applying the VEDA, the next step is to highlight the desired details such as plate details and vertical edges in the image. The HDD performs NAND–AND operation for each two corresponding pixel values taken from both ULEA and VEDA output images.

6.CRE (Candidate Region Extraction)

Candidate Region Extraction, in which the process is further divided into four steps.

- Count the Drawn Lines per Each Row
- Divide the Image into Multi groups
- Count and Store Satisfied Group Indexes and Boundaries of the plate image
- Select Boundaries of Candidate Regions of the plate image.

Count the Drawn Lines per Each Row:

The number of lines that have been drawn per each row will be counted and stored in matrix variable.

Divide the Image into Multi groups:

To reduce the consumed time, gathering many rows as a group is used here. Therefore, dividing the image into multi groups could be done using the following:

how_mny_groups = height / *C*

Count and Store Satisfied Group Indexes and Boundaries of the image:

It is useful to use a threshold to eliminate those unsatisfied groups and to keep the satisfied groups in which the LP details exist in.

Select Boundaries of Candidate Regions of the plate image:

This step draws the horizontal boundaries above and below each candidate region. Candidate regions interpreted from horizontal-line schemed, and these conditions require an additional step before the LP region can be correctly extracted.

7.PRS (Plate Region Selection)

The next step is Plate Region Selection, this process aims to select and extract one correct License Plate.

Cregion = 0, blckPix ≥ PRS × colmnHght
255, otherwise (1)

blckPix ≥ *P*RS × colmnHght, where *P*RS represents the PRS factor. The *P*RS value is reduced when the blurry level is high to highlight more important details, and it is incremented when the blurry level is less. Therefore, the numerical representation for selecting the LP region can be formulated as (1) where *C*region represents the output value for the current pixel of the currently processed candidate region. If *C*region = 0, consider the checked pixel as an element of the LP region; otherwise, consider it as background. After applying the (1) on the image that contains the candidate region. The output image contains a single candidate region. This effect of changing the *P*RS value is given in the example. the boundaries of the plate area are detected, and the corresponding LP is marked.

9. Harris Corner Point Detection

Harris and Stephens proposed to detect corners a systematic and effective way. In this the algorithm has some problems, such as the ability to describe the corner from the peak or the dip and the robustness to noise should be improved. An improved algorithm based on modifying the detection criterion was proposed.

III. CONCLUSION

We have proposed a new and fast algorithm for vertical edge detection. The input image is converted to the gray scale image using the adaptive thresholding technique. Then the unwanted lines are eliminated using the ULEA algorithm and then the vertical edge detection algorithm is used to detect the edges. The performance is faster than the performance of Sobel by five to nine times depending on image resolution. The results show improved detection accuracy with fast processing time using the harris corner point detection.

REFERENCES

[1] S. N. Huda, K. Marzuki, Y. Rubiyah, and O. Khairuddin, “Comparison of feature extractors in license plate recognition,” in Proc. 1st IEEE AMS, Phuket, Thailand, 2007, pp. 502–506.

[2] S. Thanongsak and C. Kosin, “The recognition of car license plate for automatic parking system,” in Proc. 5th Int. Symp. Signal Process. Appl., Brisbane, QLD, Australia, 1999, pp. 455–457.

[3] H. Bai and C. Liu, “A hybrid license plate extraction method based on edge statistics and morphology,” in Proc. 17th Int. Conf. Pattern Recognit., Cambridge, U.K., 2004, pp. 831–834.

[4] M. Fukumi, Y. Takeuchi, H. Fukumoto, Y. Mitsura, and M. Khalid, “Neural network based threshold determination for Malaysia license plate character recognition,” in Proc. 9th Int. Conf. Mechatron. Technol., 2005, pp. 1–5.

[5] E. R. Lee, K. K. Pyeoung, and J. K. Hang, “Automatic recognition of a car license plate using color image processing,” in Proc. IEEE Int. Conf. Image Process., 1994, pp. 301–305.

[6] R. Parisi, E. D. Di Claudio, G. Lucarelli, and G. Orlandi, “Car plate recognition by neural networks and image processing,” in Proc. IEEE Int. Symp. Circuits Syst., 1998, pp. 195–198.

[7] T. Naito, T. Tsukada, K. Yamada, K. Kozuka, and S. Yamamoto, “Robust license-plate recognition method for passing vehicles under outside environment,” IEEE Trans. Veh. Technol., vol. 49, no. 6, pp. 2309–2319, Nov. 2000.

[8] H.-H. P. Wu, H.-H. Chen, R.-J. Wu, and D.-F. Shen, “License plate extraction in low resolution video,” in Proc. IEEE 18th Int. Conf. Pattern Recognit., Hong Kong, 2006, pp. 824–827.

[9] A.M. Al-Ghaili, S. Mashohor, A. Ismail, and A. R. Ramli, “A new vertical edge detection algorithm and its application,” in Proc. IEEE Int. Conf. Comput. Eng. Syst., Cairo, Egypt, 2008, pp. 204–209.

[10] D. Bradley and G. Roth, “Adaptive thresholding using the integral image,” J. Graph. Tools, vol. 12, no. 2, pp. 13–21, Jun. 2007.

[11] P. D. Wellner, “Adaptive thresholding for the DigitalDesk,” Rank Xerox Ltd., Birmingham, U.K., Tech. Rep. EPC-1993-110, 1993.