

Vertical-Edge-Detection-Algorithm Based Car-License-Plate Detection

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Abstract:

Automatic number plate recognition, Car License Plate Detection (CLPD) is a mass surveillance method that uses character recognition on images to read number plates. Existing system focused on character segmentation (CS) and License plate detection in the license plate (LP) recognition system, in which low contrast and dynamic-range problems occurs. In this paper we present a robust car license plate detection method using vertical edge detection algorithm (VEDA). To extract number plate, first image binarization technique is applied. Then for reorganization of LP data, system starts character identification process which is based on VEDA and Sobel Edge Detector. After character identification process, results of VEDA are compared with Sobel Edge operator in terms of accuracy, Algorithm complexity, and processing time. Proposed method shows better accuracy as compare to Sobel operator In the proposed system we are also identifies the vehicle status.

Keywords: Car License Plate Detection (CPLD), VEDA, Character Recognition, Sobel edge detection, LP (license plate), Automatic license plate recognition (ALPR).

1. INTRODUCTION

In recent years, Intelligent Transport systems have a wide impact in peoples life as their improve scope of transportation

safety and mobility to increase the productivity of users advanced technologies. Some of the companies and residential areas parking system can be done in many ways

such as hiring security guards to give and then receive cards from car drivers using RFID technology etc. for more effectiveness CCTV's are installed to provide secure parking and to utilize the space properly but still have some drawbacks like time delay to check and get pass. The same issues are raised in highway tollgates and heavy traffic leads to huge maintenance issues. This paper describes to resolve all these issues based on Digital Image Processing technology is used to identify the vehicles by capturing their car license plates (CLPs).

The proposed number plates recognition is also known as Automatic number plate detection vehicle identification, for cars. Detection of car license plates region system consists of mainly three contribution, first one is binarization of input image (LP) by using adaptive threshold technique, then apply unwanted line elimination algorithm(ULEA) to remove the unwanted line and noise in binarized image. Then after that apply the segmentation technique for detecting the number plate region based on edges of characters starting region to ending region on number plate region. These methods are the most important part in the CLPD system because it affects the systems

accuracy. Fast and accurate CLP detection systems have many issues that should be resolve the poor quality images, processing time, number plate region and background details. For the tracking and detection of vehicle number plates for crime prevention cameras are used and installed in front of police cars to detect the vehicle number plate and identify those vehicles. These numerous application of vehicle tracking outstanding cameras are lead to increase the cost of the system in both hardware and software implementation. This paper proposes LP recognition system with lowest cost of its hardware devices, and also it will give more practical and accurate than before. And finally we compare results of VEDA and Sobel edge operator to find out which is better. The paper proposed design method for CLPD, which is low resolution web cameras are used. However the web camera is used to capture the image and to processes an offline it perform to detect the plate region from the whole scene image. The vertical edge extraction and detection is a very important task in the CLPDRS because it affects the system's accuracy and computation time.

2. Related work

A vertical edge map has been used for LPD for many years [3]. The given algorithms used a one-directional Sobel operator to extract the vertical edges. Nevertheless, some undesired details such as horizontal edges are kept in such vertical edge map. Therefore, these details can increase the processing time and reduce the system accuracy. In [2], [17] an image enhancement and Sobel operator was used to extract the vertical edges of the car image. They used an algorithm to remove most of the background and noisy edges. Finally, they searched the plate region by a rectangular window in the residual edge image.

In[11], (1)extracting the Plate region, edge detection algorithm and vertical projection method are use.(2) In segmentation part filtering, thinning and vertical and horizontal projection are used. And finally, (3)chain code concept with different parameter is used for recognition of the characters. Shows final system Efficiency: 98%. Limitation: The proposed method is mainly designed for real-time Malaysian license plate. In[7],Extraction of plate region: edge detection algorithms and smearing algorithms, segmentation of Characters:

smearing algorithms, filtering and some morphological algorithms, recognition of plate characters template matching. This shows extraction of plate region :%97.6 segmentation of the characters :%96 , recognition unit:%98.8.overall system performance: %92.57 recognition rate . Limitation: it having some limitation like it recognition of car license plate only, and this system is designed for the identification of Turkish license plates.

In[12], It involve three approaches:(1)in plate localization Noise alleviation, Changing color space, Intensity dynamic range modification, Edge detection, Separating objects from background, Finding connected component, Candidate selection, all above process are used (2) in segmentation part multistage model are used.(3) for the recognition artificial I l l Feed forward neural network is used. Limitation: detection only for English and Parisian number plate.

3. Proposed Method

Inthis paper the proposed method has three contributions: The VEDA is proposed and used for detecting vertical edges; the proposed CLPD method processes low-

quality images produced by a web camera, which has a resolution of 352×288 with 30 fps; and the computation time of the CLPD method is less than several methods. In this paper, the color input image is converted to a grayscale image, and then, adaptive thresholding (AT) is applied on the image to constitute the binarized image. After that, the ULEA is applied to remove noise and to enhance the binarized image. Next, the vertical edges are extracted by using the VEDA. The next process is to detect the LP; the plate details are highlighted based on the pixel value with the help of the VEDA output. Then, some statistical and logical operations are used to detect candidate regions and to search for the true candidate region. Finally, the true plate region is detected in the original image. The flowchart of the proposed CLPD method is shown in Fig. 1.

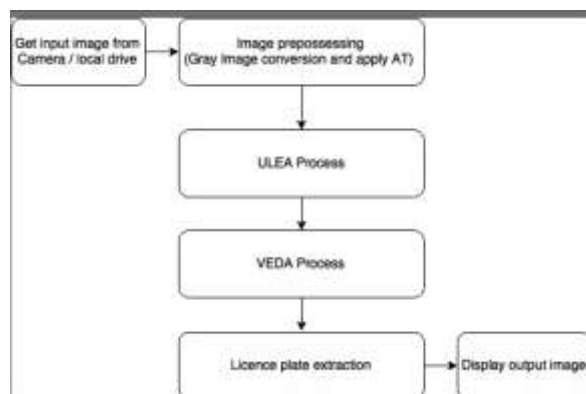


Figure1. Flowchart of proposed system

3.1 Adaptive Thresholding Process :

The input image is grey scale and has the values between [0-255]. Fig. 2 shows the input image and the result of applying adaptive thresholding the idea in algorithm is that the pixel is compared with an average of neighbouring pixels. 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. The range $0.1 < T < 0.2$ in our method. However, algorithm depends on the scanning order of pixels. Since the neighbourhood samples are not evenly distributed in all directions, the moving average process is not suitable to give a good representation for the neighbouring pixels. Therefore, using the integral image solved this problem.

$$Intgr1Img(i, j) = \begin{cases} sum(i) & \text{if } j = 0 \\ Intgr1Img(i, j - 1) + sum(i) & \text{otherwise} \end{cases} \quad (1)$$



Fig2.a input image



Fig2.b thresholding image

3.2 ULEA Process :

In Fig. 2(b), we can see that there are many long foreground lines and short random noise edges beside the LP region. These background and noise edges are unwanted lines. These lines may interfere in the LP location. Thresholding process in general will produce many thin lines which do not belong to car plate region. So elimination of these lines will contribute in CLPDRS accuracy and reduce the processing speed. Therefore, an algorithm is proposed in order to eliminate these unwanted lines. It is clear from Fig. 2(b) that the image has some unwanted lines in angles 00, 90,45, and 135 with width of one pixel. Therefore, we have proposed an algorithm to eliminate them from the image.

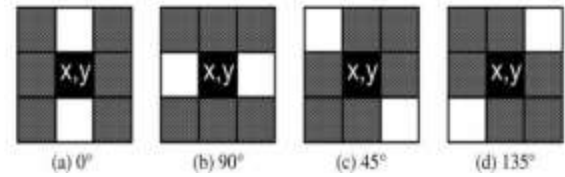


Fig.3 four cases for converting the center pixel to background

- (a) Horizontal
- (b) vertical
- (c) right inclined
- (d) left inclined

A 3x3 mask is used throughout all image pixels. Only black pixel values in the threshold image are tested. Supposed that $g(x,y)$ are the values for threshold image. Once, the current pixel value located at centre of the mask (x,y) is black, the 8-neighbor pixel values are tested. If two corresponding values are white in the same time, then The current pixel is converted to white value as background pixel.



Fig4. ULEA process output

3.3 VEDA Process:

In order to distinguish the plate detail region, particularly the beginning and the end of each character VEDA is most suitable. Then the plate details will be easily detected and the character recognition process will be done faster. After the Thresholding and ULEA processes, the image will only have black and white regions and the VEDA can easily processing these regions. In an image, ROIs are rectangular regions with white background and dark characters. The most important characteristic of these rectangles is the existence of lots of edges. The idea Of the VEDA concentrates on intersections of black–white and white–black as shown in Figure below.



(a)black white (b)white-black

Fig5. The intersect areas of black-white and white-black areas

A 2×4 mask is proposed for this process. The centre pixel of the mask is located at points (0, 1) and (1, 1).By moving the mask from left to right, the black–white regions will be found. Therefore, the last two black

pixels Regions will only be kept. Similarly, the first black pixel in the case of white–black regions will be kept. This process is performed for both of the edges at the left and right sides of the object-of-interest. The proposed mask has the size of 2×4 to fulfill the following two criteria.

(a)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 ”. Simply, after each two pixels are checked at once, the first sub mask is applied 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 intersection of black–white regions. Similarly, the third sub mask applied on the intersections of white–black regions. Thus, the detected vertical edge has the property of a 1 pixel width.

(b) The number “2” points out the number of rows that are checked at once. The consumed time in this case can be less twice in case each row is individually checked. 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 moving from top to bottom and from left to right. If the four pixels at locations (0, 1), (0, 2), (1, 1), and (1, 2) are black, then the other mask values are tested if whether they are black or not. If the whole values are black, then the two locations at (0, 1) and (1, 1) will be converted to white.



Fig6. VEDA output

3.4 Car License Plate Detection (CLPD):

To extract plate region and characters four steps are involved. They are Highlight Desired Details(HDD), Candidate Region Extraction (CRE), and Plate Region Selection (PRS).

a) HDD: 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. This process depends on the VEDA output in highlighting the plate

region. All the pixels in the vertical edge image will be scanned.

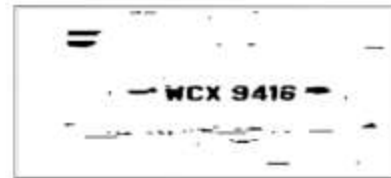


Fig7. HDD Output

When there are two neighbor black pixels and followed by one black pixel, as in VEDA output form, the two edges will be checked to highlight the desired details by drawing black horizontal lines connecting each Two vertical edges. First, these two vertical edges should be surrounded by a black background, as in the ULEA image. Second, the value of horizontal distance hd represents the length between the two vertical edges of a single object. After all pixels are scanned, the regions in which the correct LP exists are highlighted.

b) CRE: Candidate Region Extraction process is divided into four steps,

i) Count the Drawn Lines per Each Row: The number of lines that have been drawn per each row will be counted and stored.

ii) 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.

iii) Count and Store Satisfied Group Indexes and Boundaries: It is useful to use a threshold to eliminate unsatisfied groups and to keep the satisfied groups in which the LP details exist in.

iv) Select Boundaries of Candidate Regions: This step draws the horizontal boundaries above and below each candidate region.

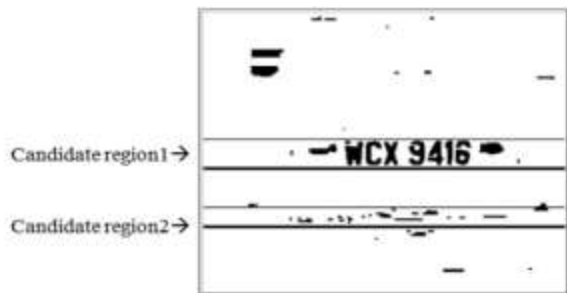


Fig8.outputs of boundaries drawing candidate regions

4. Results



Fig9. Input color image



Fig10.extracted output image



Fig11. Vehicle status



Fig12. Vehicle status

IV. CONCLUSION

In this paper, we have proposed a new technique by using VEDA in order to detect number

plate of vehicles. The VEDA contributes to make the whole proposed CLPD method faster, as Sobel operator which uses Gaussian filter to remove noise. The computation time of the CLPD method is low, which meets the realtime requirements. From above results it proves that proposed

method shows better accuracy as compare to Sobel operator.

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