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Vehicles License Plate Recognition Based on Line Scanning of Digital Image

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Abstract: In this paper, a computer vision system, according to digital image processing methods to recognize car license plate is described. Traffic images are captured by a video camera and digitized in to a computer. Vertical and horizontal line scanning is used. The gray scale in horizontal and vertical lines and a treshold help to find the coordinate of the plate. Chosing a second treshold based on area of the plate make seperation of number and alphabetic characters easy.

Keywords: License plate recognition, Image processing

1 Introduction

Automatic vehicle identification is the most important part to commercial applications such as surveillance, monitoring, billing and ticketing. In the area of automated transport systems, license-plate recognition by visual image processing is the key part of system. As Figure 1 shows visual vehicle-identification system is mainly consist of a few distinct modules with specific signal-processing functions [1]. Image acquisition is the first step in any plate recognition system. The main problems to be solved in license-plate recognition application based on image, especially for small-scale facilities, are as follow: capability of capturing fine, under greatly varied illumination conditions from twilight up to noon in the sunshine; sensing system have to capable of capturing no blurred images against quickly passing vehicles and finally developing recognition algorithms flexible for sensor[2]. Acquiesced images with a low-level imaging module are processed to restore signal quality by noise filtering, contrast enhancement, etc. The algorithms are usually selected according to the kind of sensor used as well as environmental conditions. As a second step, the location of interesting scene regions is attained by a segmentation process. This crucial phase may involve segmentation of image [3]-[4]. Researchers used different methods to recognize the plate. The main methods are fuzzy methods [5]-[8], neural networks method [9]–[14]. Location results feed the actual vehicle identification module, which is generally supported by optical character recognition methods. In some applications requiring archival facility for time-logging purposes, image-compression algorithms can also be applied to reduce storage space.

In our work license plate is recognized and transferring to traffic center. There two stage first finding area of the plate and the second recognizing the number and Persian alphabetic characters exist in the plate.

2 Experimental setup and results

There are seven parts as: data acquisition, the plate location, improving the plate image

resolution, recognition and transferring to the traffic center, comparing the plate with the data base, making decision and command and finally recording the information such as the plate; time and place of car. In the following briefly each part is explained.

2.1 Image acquisition

A commercial camera take a 640 by 480 pixel image from back of cars. The image has 256 gray levels. Our experiences show the back of car is better than the front of car. The reasons are as follow:

- The illumination of image from front is more than the back
- The plate in the back are more readable and safe
- Logos and other signs in windscreen mislead the program
- Driver interested in making low their distance from front car

2.2 Recognition of the plate location

This is the important part in our algorithm. The ratio of area of the plate to the whole image is 0.05. The golden key in recognition the plate location is high period of difference in gray level between the background and number plus alphabet if there is any. The algorithm chose a threshold and starts to scan the image horizontally. Figure 2 shows the input image to the program. If the number of changes around the threshold is high it is the start of the plate. It is X_{min} of the plate. As the number of changes becomes normal, the area of the plate is finished and the X_{max} is determined. By scanning vertically in the same manner the Y_{min} and Y_{max} are determined. Figure 3 shows schematically the manner in which program finds the coordinates of the plate. It is important to emphasize that, the scanning is done for some line in image. The distance between different scan lines is about half of dimensions of the plate. Figure 4 show two result of algorithm for real images.

2.3 Improving the resolution

For economic reason there is no high resolution camera used in this work. We have to improve image with software programming. There are many methods such as, Lucy Richardson Algorithm, Wiener filter, Noise Signal Ratio (NSR), Noise Power (NP) & Autocorrelation Function and the blind deconvolotion algorithm with using weight array on edges. To improve the quality of image. Besides of constraint, the Wiener filter is used. The reason for using this kind filter is as follow: our camera position is fixed and the degree of sight is between 70 -110 degree, it means the stretch and blurring of image is in specific direction. Therefore, the main constraint of Wiener filter is satisfied.

2.4 Recognition of the plate

The area of the plate is found based on previous stages. The image is scanned vertically and the gray level in each column is summed. When the summation is more than a secondary threshold it is a number or alphabetic character in the plate. The following formula does this task.

$$Sth = (Y_{max} - Y_{min} + 1) \times Apg$$

In which *Sth* stands for secondary threshold and *Apg* stands for average of all pixel's gray levels in the plate. Figure 6 shows the algorithm. Figure 7 shows the result of applying the program to the different plates.

3 Conclusion

This algorithm is simple and implement economically. It is not sensitive to the length of the plate and the number and alphabet character in the plate. It isn't recognized the tick alphabet, like some other algorithms. In 40 second the plate is recognized and sending to the traffic center.

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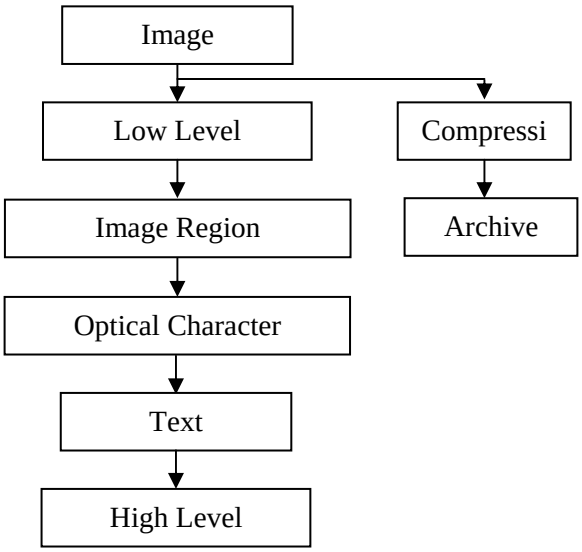

Figure 1. Global blocks of an automated license-plate recognition system

Figure 2. Input image to the program

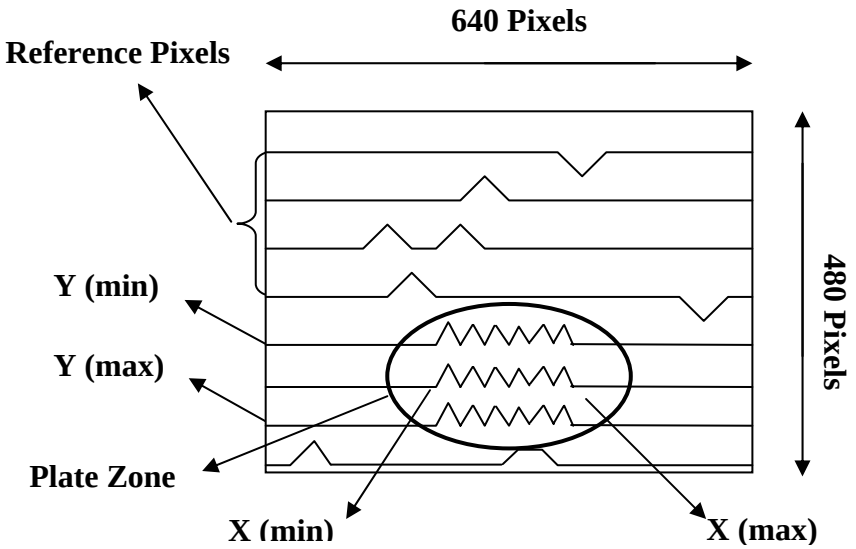

Figure 3. Recognition the area of the plate

Figure 4. Result of program two kinds of iranian plate, (left) the result of program, (right) the image of plate