정보 및 제어 심포지엄(ICS'04) 2004. 5. 22

A New Algorithm of License Plate Location

김 단, 손 영 익, 김 갑 일
(Jin Dan, Young Ik Son, Kab Il Kim)

Abstract - Automatic license plate recognition (LPR) is one of the critical techniques of the intelligent transportation system (ITS), in which license plate location plays an important role. In this paper, through surveying the international existing techniques, a new method for locating license plate is proposed: utilize row scan method to locate up and down boundary of the plate; and based on the location of up and down boundary, take advantage of the feature of plate area to locate left and right boundary of the plate. The tests of using the proposed algorithms have been conducted. The experimental results show that the proposed approaches are reasonable and accurate.

Key Words : license plate recognition, license plate location, row scan, feature of plate area

1. Introduction

With the development of modern traffic, the traffic automatic arrangement is gained more and more attention. As an important form of automatic car recognition, license plate recognition (LPR) system is widely used in the electronic charge, entrance control, car detection and so on.[1] In such system, the location of license plate plays a key role, and it will affect whether or not we can get right character recognition. The classical location methods include: frequency domain analysis method based on DFT transform, which was presented by R.Parisi;[2] the method based on Niblack threshold algorithm and self-adaptive boundary search algorithm, which was presented by Charl Coetzee.[3] But because the license plate recognition is taken outside, there will be weather, background and other factors can affect it. Therefore such methods are not so good.

In this paper, the characteristic of license plate is analysed, and based on that, a new method to locate the license plate is presented. The tests can show the good efficiency of this method

2. Characteristic of License plate

In China, the most license plates are put into practice in 1992 by government [4]. And it has four major types: blue background white character, yellow background black character, white background black character and black background white character. The following pictures show two kinds of them.

(a) blue background white character

(b) black background white character

Figure 1 two kinds of Chinese license plate

There are seven characters in the license plate. Generally, the first one is Chinese character, which is the shortened form for each province, the second one is capital English letter, which not include "O" and "I" the third one is English character or Arabic numeral the other four are all Arabic numerals. The width of plate is 45 cm and the height of plate is 15cm. For the individual character, its width and height are 45 mm and 90 mm respectively.

From human vision, we can know that because there is difference in the gray level value between the character and background, there must be some changes of the gray value at the edge of character. And this characteristic is the gist of finding plate.

3. The algorithm of plate location

This algorithm includes three main parts: preprocess, up and down boundary location, and final location.

3.1 Preprocess

The pictures we acquired are most color pictures. But because of complexity and diversity of color, it can be affected by all kinds of beams. It is not good for us to

저자 소개
* 金 丹 : 明知大學 電氣學科 碩士課程
** 孫 英 翼 : 明知大學 電氣學科 助教授 · 工博
***金 甲 一 : 明知大學 電氣學科 教授 · 工博

use color picture. Hence, first we need convert the color image into gray level image. And then we need to convert the gray level image into binary image.

3.2 Up and down boundary location

After preprocessing image, we adopt "check the change times of pixel's value line by line"method to locate up and down boundary.

First, check the pixel's value line by line. If the value between two pixels neighbor to neighbor is not equal, add 1 to the counter, which counts the change times. And if the whole change times of a line are more than 15 (because this line passes the plate area, there are 7 characters in this area, then the least edge numbers are 14, and the plate has frames, therefore, here, we use 15 as the threshold is available), we can think this line maybe lie in the plate area. Memorize this line, and make the counter, which counts the lines, equals to 1. Use the same way to calculate next line's value change times, if it is satisfied with the condition, add 1 to the line counter. If it is not, make the line counter become to 0 until we get the satisfied line again. Considering the height of the plate, if such continuous satisfied lines are more than 15, we can look such area as a candidate of plate. Because the license plate almost locates at the bottom of the pictures, we can think the last candidate is the one, which we need in fact. In this way, we get the up and down boundary location of the license plate.

3.3 Final location

Now we use the information characteristic of the license plate to complete the final location of license plate. We extract a line lies in the middle of the picture, which we get from last step. Because of the well regulated arrange of the characters in the plate area, there maybe gray level value changes of the points on this line. And such changes follows some rules below:

(1) The distance between two changes is usually less than 20.

(2) At the same time, the continuous change times are more than 12.

If we can get such area, where the changes can meet the conditions above, we can say that succeed in final location.

4. Experiment results

In this paper, I use several car pictures to get my experiment results, and the experiment results show that the proposed algorithm works very well.

The experiments results are shown as follows:

Figure 2, 3. original car1 and its located license plate

Figure 4, 5. original car2 and its located license plate

Figure 6, 7. original car3 and its located license plate

Figure 8, 9. original car4 and its located license plate

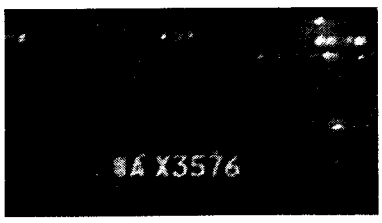

Figure 10, 11. original car5 and its located license plate

5. Conclusion

This paper presents a new method to locate the license plate. How to locate the plate exactly is a vital step in the LPR system, it is related the veracity of character segmentation and character recognition. Using the method proposed in this paper, we could get the whole license plate area. And providing a satisfied image source for character segmentation.

6. Acknowledgment

The authors would like to thank the Korea Ministry of Science and Technology and the Korea Science and Engineering Foundation for their support through the ERC program.

Reference

[1] Yuan Bao-min, Yu Wan-bo, Wei Xiao-peng. A Survey of License plate Location Technology[J]. Journal of Dalian University, 2002,23(2).

[2] R PARISI, et al. Car Plate Recognition by Neural Networks and Image Processing[A]. Proc IEEE International Symposium on Circuits and Systems[C], USA, 1998, May 31-June 3.

[3] CHARL COETZEE, et al. PC Based Number Plate Recognition System[A]. Proc IEEE International Symposium on Industrial Electronics[C]. 1998: 605-610.

[4] Liao Xiang-yun, Xu Jin-biao, Gong Shi-wei. The Research of Recognition Technology of Vehicle License Plates[J]. Microcomputer Development, 2003, 6(13)