

Survey on- Text-line construction and binarization technique for VLPR

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Abstract— A new method to VLPR is presented in this paper. License plate localization and character segmentation and recognition are the research hotspots of vehicle license plate recognition (VLPR) technology. According to the text-line construction result and the characteristics of the license plate character arrangement, the license plate location will be determined. And then the locally optimal adaptive binarization is utilized to make more accurate license plate localization. The results show that this method can recognize characters precisely and improve the ability of license plate character recognition effectively.

Keywords- License plate detection, license plate recognition, hybrid discriminative restricted Boltzmann machines, extremal regions.

I. INTRODUCTION

The vehicle license plate recognition (LPR) technology has important application in Intelligent Transportation Systems (ITS) and has been used extensively in highway and bridge charge, port, airport gate monitoring, and so on. It is conceptually considered that the two key separate processing stages of license plate recognition are license plate localization (LPL) and License Plate Character Recognition (LPCR). Normally the license plate recognition system is running outdoors, and the images are easily interference because of complex background and a wide range of illumination conditions.

The hot problems are how to localize the license plate and segment character in the license plate from images of different backgrounds and illumination conditions precisely, reliably and fleetly. At present, some scholars have done a lot of researches on these problems and promoted the development of this domain. License plate localization, including the algorithms to detect the rectangular area of the license plate in an original image, is the most crucial and difficult processing stage.

The success and accuracy of the localization will directly determine the post recognition and identification accuracy.

II. LICENSE PLATE LOCALIZATION

A. Binarization

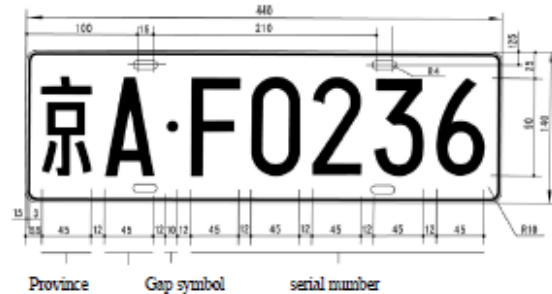
Generally, license plate area is often with high contrast. Therefore, the foregrounds and backgrounds can be separated by binarization method. Considering the inherent nature of vehicle images, we propose a two-stage binarization mechanism in this study. In the first stage, detect license plate candidates using Otsu method. The license plate candidates may contain noises and incorrectly selected regions so that they could be considered to be license plate by mistakes. Character filtering and text-line construction were operated to verify the candidates. The second stage binarization will be operated after the text-line construction. After the text-line construction, the incorrect candidates will be removed, only the license plate region is preserved. In the second binarization stage, the preserved license plate region will be divided into several regions according to the features of the license plate, and each region will be binarized by locally optimal adaptive binarization

B. Text-line construction

In this section, text-line construction is adopted to verify the location of the license plate. There might be several candidates regions after the first stage binarization and character filtering, but only the candidates region that can construct the text-line can be preserved to be the license plate region. In China, the standard license plate consists of 7 characters, of which the first is the Chinese character, the second is capital letter, third and fourth may be a capital letter, or a number, the fifth, sixth and seventh are currently digital. Only the 65 characters shown in Table I can be used in the license plate. Fig. shows the standard license plate

TABLE I. CHARACTERS IN LICENSE PLATE

京	津	冀	晋	蒙	辽	吉	黑
沪	苏	浙	皖	闽	赣	鲁	豫
鄂	湘	粤	桂	琼	渝	川	贵
云	藏	陕	甘	青	宁	新	0
1	2	3	4	5	6	7	8
9	A	B	C	D	E	F	G
H	J	K	L	M	N	P	Q
R	S	T	U	V	W	X	Y
Z							

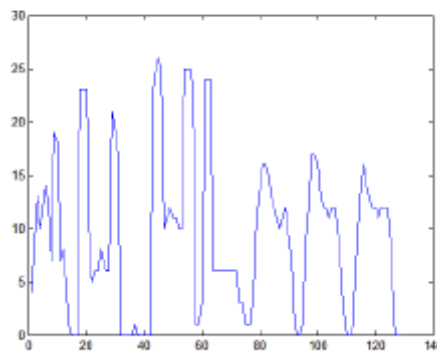


III. LICENSE PLATE CHARACTER SEGMENTATION

To recognize the Chinese characters, letters and numbers, a single character must be extracted from vehicle plates. The segmentation results directly affect character recognition. The license plate image is binarized before separation, then row scanning method based on prior knowledge is applied to process the frame and rivet. In this article the segment method of vertical projection information with prior knowledge is developed, and is modified to improve the precision. Before the recognition, the seven characters must be separated out from the plate in the picture. If the total gray values of every column pixels are calculated based on binary images, the vertical projection can be acquired. The chart of vertical projection is shown in Fig



(a) The license plate image



(b) The vertical projection of the license plate image

IV. EXTRACT CHARACTER FEATURE

The aim of character feature extraction is to find the most efficient feature from feature space. Therefore, how to choose an efficient feature from many features is the key to recognize character. Usually the method of coarse grid feature extracting is defined that the characters to recognize should be normalized firstly by size and position, divided into $N \times N$ grids equally, and then the number of white pixels in grids is calculated in turn to get one $N \times N$ dimension grid feature by numeric form. Because coarse grid feature belongs to local gray feature, even if it can show total shape distribution of character, but the ability of anti-disturbance of stroke position change is poor and thus the recognition rate will be decreased. What's more, the coarse grids features ignore some detail features which are very important to character classification with similar structure.

VI. SIMULATION RESULTS AND ANALYSIS

In this section, experiments were performed using the proposed method. The sample images were color vehicle license plate images of different size, clarity, illumination and inclination. In each figure, (a) is the original image. The gray image is shown in (b). (c) to (e) are demonstrated as the license plate localization results using the proposed method.



VII. CONCLUSIONS

A novel method for license plate recognition is proposed in this paper. Local adaptive binarization and text-line construction are operated to localize the license plate. After the license plate localization, the method of vertical projection information with prior knowledge is proposed to segment character and extract the statistic feature. The multilevel classification RBF neural network is then used to recognize with feature vectors as input. The tested results show that the proposed method can recognize Chinese character, capital letter and number correctly and efficiently.

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