A Review on License Plate Detection and Recognition

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Abstract— License plate recognition is process of extracting License plate area from image and converting them into human recognizable characters. License Plate Recognition has been widely used for Traffic surveillance, law enforcement, Parking and toll collection System. Automatic License plate recognition (ALPR) is also called as automatic number plate recognition (ANPR). ANPR system is divided into Image acquisition, License Plate extraction and Segmentation, and Character recognition. This paper represents different algorithms proposed by researchers for recognizing license plate from captured image.

Key words: ALPR - Automatic License Plate Recognition, ANPR – Automatic Number Plate Recognition

I. INTRODUCTION

The vehicle number plate is a numeric or alphanumeric code that uniquely identifies the owner of vehicle within the issuing country database. License plate number provides information such as Country, state, District. It is a metal or plastic plate attached to the front and rear of a vehicle. Being unique for every vehicle, the number plate is an important resource for recognizing owner of vehicle from the country information database.

Automatic Number Plate Recognition (ANPR) was firstly introduced in 1976 and gained much popularity during the last decade along with the improvement of digital cameras. ANPR is an image processing technology which allows extracting vehicle license plate number from digital camera images. It consists of a camera that has the capability of capturing an image, finds the location of the license plate in the image, extracts the characters using character recognition methods then translates into alphanumerically readable character or string. The block diagram of ANPR system is shown in fig 1.

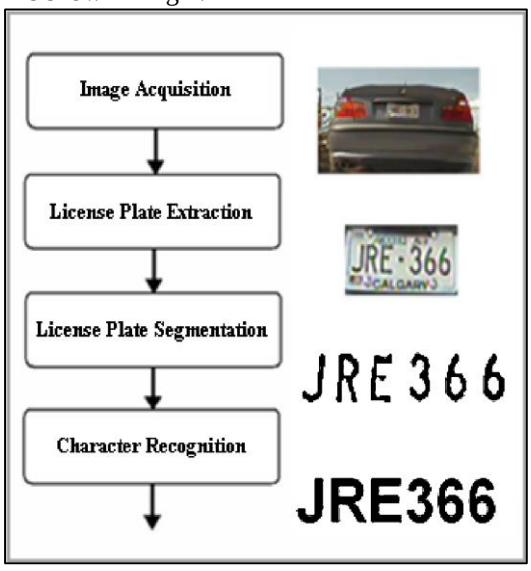

Fig. 1: Four stages of an ALPR system [10]\

The ANPR system is divided into four steps, the first step is capturing a vehicle image of front or back view. Second step is the detection or localization of number plate and then extract vehicle number plate from image. Third step is use of image segmentation technique for extracting or localization of each character. Segmentation is for individual character recognition. Final step is character recognition. Optical character recognition (OCR) is one of the important methods to recognize the each character with the help of database stored for respective alphanumeric character.

The main goal of this paper is to study efficient and optimized algorithms for detection and recognition of cars by their plate numbers. Remainder of this paper is organized as follows. Section 2 presents the literature survey. Section 3 concludes the paper.

II. LITERATURE SURVEY

In the License plate recognition system, many researches divided the topic into three parts: License plate detection, Character segmentation and Character recognition. All research work done in License plate recognition area focuses on how to achieve better recognition accuracy/rate, that is, reducing false recognition as much as possible and make effective identification of License plate characters from image sequences.

Chang et al. [1] employed the HSI and color edge to locate the license plate. The color space has a better linear independent than RGB. They built H, S, I and E (edge) maps which are aggregated by fuzzy operations. Finally optical character recognition (OCR) is done by neural network method to recognize characters.

Duan et al. [2] proposed a method which combines contour and Hough transform to detect license plate in static picture. They located the candidate plate area by finding the contour in the edge space, and also Hough transform is applied to filter the faulty plate portions. However, it is possible that the edge of license plate may belong to an imperfect contour or noise under the varied environments.

In [3], a new and fast vertical edge detection algorithm (VEDA) was proposed for license plate detection. VEDA showed that it is faster than Sobel edge detection operator by about seven to nine times.

In [4], blocks with high edge magnitude are considered as possible license plates areas. Since block processing is not depending on the boundary edges of license plate, it can be applied to any image containing license plate boundary. The recognition accuracy for 180 pairs of images is 92.5%.

In [5] techniques such as image enhancement, edge detection, unsharp masking, filtering used in the extraction process. For character segmentation connected components are identified as individual number plate characters. Template Matching is used for Optical Character Recognition.

Horizontally scan the image, looking for repeating contrast changes. They assume that the contrast is sufficiently good between the characters and the background and there are at least two to four characters whose minimum vertical size is 15 pixels. A differential gradient edge detection technique is used. In outdoor condition accuracy about 99% was achieved [6].

Template matching is a simple and mostly used method for character recognition [7]. This method calculates similarity between a character and the templates. The template that is the most similar to the character extracted is recognized as the target. Mostly template matching methods make use of binary images because the grey-scale image is always changing due to any change in the lighting condition [8].

Character recognition in [9] uses normalized cross correlation to match the extracted characters from license plate with the templates. Each template scans the character using column to calculate the normalized cross correlation. The template with the maximum value is the most similar. Template matching is used for recognizing single-font,, nonbroken, nonrotated and fixed-size characters. If a character is different from the template due to any noise, font change, rotation the template matching produces incorrect recognition.

In [10] researchers have given survey on various existing ALPR techniques by dividing them according to the features used. Comparisons of them in terms of pros, cons, accuracy, recognition results, and processing speed were given in form of table. Future work for ALPR system was also given at the end of paper. The future research of ALPR should concentrate on recognition of multistyle plate, video-based ALPR system using temporal information, high definition plate image processing, ambiguous-character recognition, and so on.

In [11], the problem of recognizing tilted characters is solved by storing various templates of the same character of same size with different inclination angles.

In [12] a fast and real time method has been proposed which finds tilt and poor quality plates. This method has been tested on with different data set that has background images with varying distance, angle. Hence, accuracy rate is 98.66% for plate extraction.

III. Conclusions

In general, an ALPR system is comprised of four stages. In the image acquisition stage, before selecting a digital camera some points needs to be considered, such as camera resolution and shutter speed. In the license plate extraction stage, license plate is extracted based on features such as the colour, size, the boundary, or the existence of the characters. In the license plate segmentation, characters are extracted by projecting their colour information, or by matching their positions with template using template matching method Character segmentation is also possible by extracting connected component. Finally, the characters are recognized using character recognition methods such as template matching, or by classifiers such as neural networks, support vector machine (SVM) and fuzzy classifiers. Automatic license plate recognition is most challenging due to the different formats of license plate and the varying environment. In recent years number of ALPR techniques has been proposed.

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