



Character Recognition in Automatic Vehicle License Plate Recognition

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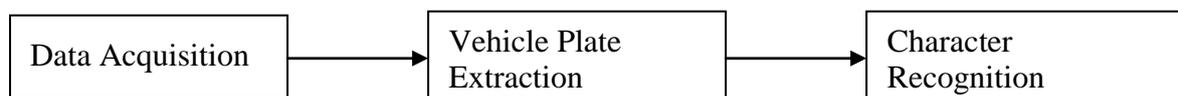
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Abstract— *Character Recognition is the final stage of Automatic Vehicle License Plate Recognition System (ALVPR). Automatic Vehicle License Plate Recognition is an image processing and pattern recognition technique used to identifying vehicle license plate number from an image or video of a vehicle. AVLPR process is divided into six stages. Firstly, Video or image of vehicle is taken using a camera. The image may contain impurities such as holes and dirt particles. The noise is removed from the image of the vehicle in preprocessing stage. In Plate Detection stage, vehicle plate is extracted from the preprocessed image of the vehicle. The features of vehicle plate like presence of characters, aspect ratio, color, size and rectangular shape are used to localize the plate. The characters on the vehicle plate are isolated in the plate segmentation stage. The final stage is to recognize the alphanumeric characters present on the vehicle plate. The features of the characters like shape, size and contours of characters can be used for character recognition. This paper will present the various methods of character recognition discussed in literature.*

Keywords— *Automatic Vehicle License Plate Recognition System (ALVPR), Segmentation, Optical Character Recognition, Artificial Neural Network, Preprocessing, Plate Detection, Template Matching, Artificial Neural Network.*

I. INTRODUCTION

Vehicles play an important role in transportation. Use of vehicles is increasing because of population growth. Therefore, controlling of vehicles is becoming a big problem. So, there is a need to recognize the vehicles. As Vehicle number plate is unique for every vehicle, we can use vehicle registration plate for this purpose. Manual recording of vehicles is time consuming, costly and not efficient. Therefore there is a need for automation of process of vehicle plate recognition. Automatic License Vehicle Plate Recognition (ALVPR) is an image processing and pattern recognition problem. Automatic recognition of car license plates plays an important role in traffic surveillance systems. Such system which is applied in parking areas, highways, bridges and tunnels, can help a human operator and improve overall quality of a service [1]. Automatic number plate recognition is a mass surveillance method that uses optical character recognition on images to read vehicle registration plates. It is a technique which is used to identify vehicles using their license plate numbers. It is the process of extraction of vehicle plate number from an image of a vehicle or video of a moving vehicle. The main use of AVPR is security. This technique is very helpful in toll collection, parking management, access control, radar based speed control, boarder control and road patrolling. The way that ALVPR work is as shown in Fig 1:



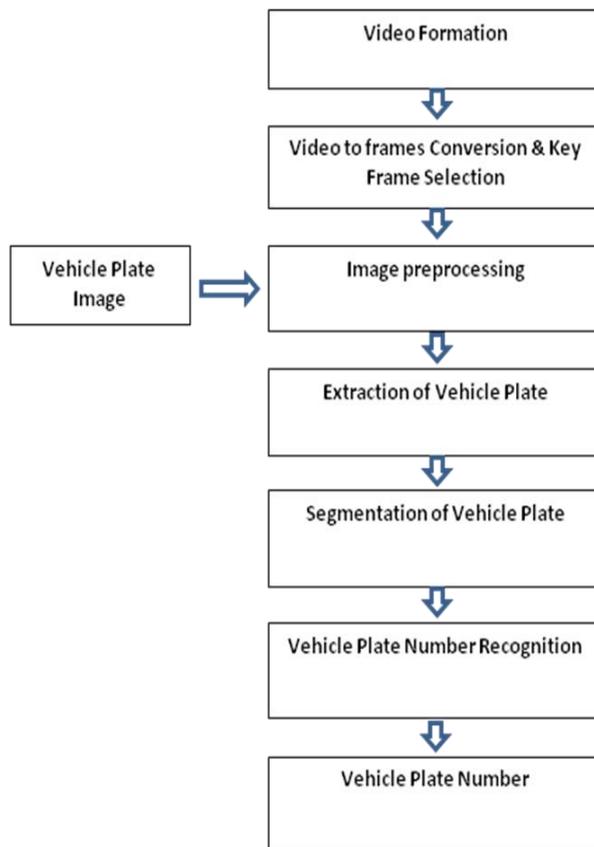
(Fig 1)

First of all the video of a moving car is taken. Then video is converted into frames. Then the key frame is to be selected. Then plate is to be extracted from the image of the car. Then software for character recognition is to be run. Character Recognition is the last and final stage of ALVPR system.

The output of ALVPR system is the Vehicle License Plate Number.

II. ALVPR PHASES

Firstly, Data is acquired using a camera. Both Video and images can be taken. Features of camera such as resolution, shutter speed and orientation have to be considered into account while making the video of a moving vehicle. Second stage is to convert that video into the frames and the key frame is to be selected. The frames may have noise. They may contain impurities such as holes and dirt particles. Therefore, after selecting the key frame, in third stage pre-processing and the noise removal is done. The contrast is also adjusted. The image is enhanced and pre-processed so that it is easy to recognize the vehicle car plate number. In fourth stage, the vehicle plate is to be extracted from that image. The input of this stage is a vehicle image and output is the portion of the image carrying the vehicle plate. In the next stage we will isolate the characters from the plate. The vehicle plate is segmented to extract the characters for recognition. The final stage is to recognize the alphanumeric numbers present on the vehicle plate. The step by step diagram is as fig 2.

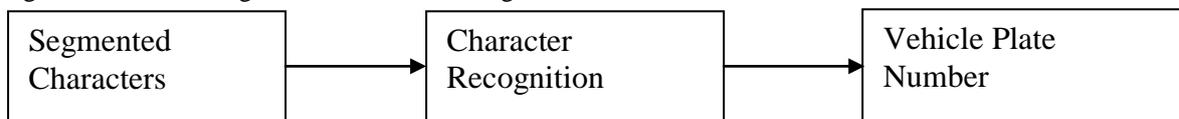


(Fig 2)

III. CHARACTER RECOGNITION

Character Recognition is the final stage of Automatic License Vehicle Plate Recognition System. Segmented Characters of the license plate is input to this stage, characters are recognized and output is the license plate number. The features of the characters like shape, size and contours of characters can be used for character recognition. As License Plate may be bend or tilted with respect to camera, extracted characters may be deformed. Characters may be noisy, broken or incomplete. Methods of Character Recognition should be able to deal with these defects. Extracted characters do not have uniform size and thickness. This may affect the Character Segmentation stage. The characters like (o, 0), (l, 1), (B, 8), (C, G) are similar and may confuse character recognizer.

Working of Character Recognition is as shown in Fig 3:



(Fig 3)

The input to Character Recognition stage is segmented characters and output is License Plate alphanumeric number of Vehicle.

IV. METHODS OF CHARACTER RECOGNITION

Authors [5], [12], [18], [20] used Template Matching to recognise the characters. In Template matching, the character image is compared to ones in the database and the best similarity is considered. To measure the similarity, a statistical method correlation based is used. Correlation is an effective method for character recognition. Seyed et. al normalized the characters before employment of the recognition algorithm [12]. In [5], template was used to compare extracted characters and typical letters, After the successful matching, final result is stored in a file. In [20], statistical correlation method is used in matching technique.

Optical Character Recognition (OCR) is used by authors in [8], [14], [16], [17], [18], [19] for vehicle license plate character recognition. OCR is used to translate human readable characters to machine readable form [19]. OCR algorithm relies on a set of learned characters. It compares the characters in the provided image to the characters in this learned stage [14]. In [6], Authors compared segmented numbers with databases victimization totally different algorithmic rule and recognised. Each separated character is classified using a simple neighbour classifier in [7].

Authors [2], [3], [4], [13], [15], [21] used Artificial Neural Network (ANN) for recognising the characters of Vehicle License Plate. In reference [2], neural network is used for extraction of a pixel. HLS values of eight neighbouring pixels are used to extract a colour of a pixel. Then, a standard back-propagation learning algorithm is used for training and

testing the data. The feed forward back propagation ANN is formed with the set of inputs, outputs and sizes of hidden layers in [4] for character recognition. Zhai et. al [9] proposed a multi-layered-feed-forward neural network to translate scanned character images into machine encoded text. Graph Grammar is used in [10] to recognise Chinese license plate. A Graph grammar consists of a set of productions rules that can be used to construct or recognise valid sentences in a graph language. In [11] two separate ANN is used to classify numbers and letters. This will improve the success rate of the recognition phase. Both of them have the same architecture but only the input numbers were differed. The merit of character recognition is that all users can train the recognition models for their special applications given in a training tool [15]. Authors in [21] used ANN in transforming low resolution features to super resolution features and each ANN is trained for each block, Increasing the number of blocks will lead to building more ANN's and thus taking longer training time. According to reference [22] methods used in Character Recognition are:

- Character Recognition Using Raw Data
- Character Recognition Using Extracted Feature

V. CONCLUSIONS

In this paper, I described the phases of ALVPR System and highlight the existing character recognition methods present in literature. Automatic License Vehicle Plate Recognition (ALVPR) is an image processing and pattern recognition problem to identify vehicle license plate Number. Automatic recognition of car license plates plays an important role in traffic surveillance systems. Such system which is applied in parking areas, highways, bridges and tunnels, can help a human operator and improve overall quality of a service. Character Recognition is the final stage of ALVPR system. The features of the characters like shape, size and contours of characters can be used for character recognition. Template Matching, OCR, ANN, BLOB (Binary Large Objects) Analysis are widely used methods to recognize the characters on the vehicle plate in literature. I discussed the ambiguity problem in character recognition. The characters like (o, 0), (I, 1), (B, 8), (C, G) are similar and may confuse character recognizer. This ambiguity problem should attract more attention than regular OCR in future research.

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