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Video Processing: Number Plate Extraction From The Moving Vehicle Using Frame Selection

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Abstract

In the recent days the vehicles are utilized to a great extent due to increase in human needs and growth in population. Hence, control of vehicles is becoming a serious problem. Automatic vehicle identification systems are used for the purpose of effective control of vehicles. The Automatic Number Plate Extraction (ANPE) system plays a significant role in Transportation System. Automatic Number Plate Recognition System is an image processing technology that identifies vehicles by their number plates. It only considers Indian vehicle for Number Plate Extraction. It does not consider Military vehicles. In existing system the number plate information is extracted from vehicle's image using morphological operations, canny vertical edge detection thresholding, and connected component analysis. The input image is first preprocessed using iterative bilateral filters and adaptive histogram equalization. In the proposed work the number plate extracts from the video rather than an image. Nevertheless, in recognizing the number plate, image from the video, unwanted frames bring about confusion for recognizing the number plate. The top five frames are selected using super resolution process. To address this problem, a memorability based frame selection algorithm that enables automatic selection of memorable frames for number plate feature extraction is introduced. In a video, multiple images of a number plate are available with different illumination, position, viewpoint, and camera distance.

Keywords - *Automatic Number Plate Recognition (ANPR), Video Processing, adaptive histogram equalization, number plate extraction, morphological operations, thresholding, Sobel edge detection, connected component analysis.*

I. INTRODUCTION

There is a great necessity for intelligent traffic management systems in order to manage with the constantly increasing traffic on today's roads. Automatic Number Plate Recognition (ANPR) is an image-processing technology that identifies vehicles by their number plates in which the number plate information is extracted from the image of the vehicle or from a sequence of images without direct human intervention. ANPR is significant in many areas such as traffic problems, borders and custom security and in areas where intense security is essential, like Legislative Assembly, Parliament and so on. ANPR is also known as automatic license plate recognition, automatic license plate reader, number plate tracking, car plate recognition, vehicle number plate recognition, automatic vehicle identification, etc. The automatic number plate recognition system consists of four main phases: 1) Image Acquisition 2) Preprocessing phase 3) Number Plate Extraction 4) Character Segmentation 5) Character Recognition phase. Firstly, the image is obtained and some preprocessing operations are performed on it to acquire the input image which is of better quality. Secondly, the precise location of a number plate is detected from the whole vehicle image and then the particular portion of the image is extracted. Thirdly the characters from the extracted area is segmented. Finally, character recognition is done where the segmented characters are recognized and output is a license plate number.

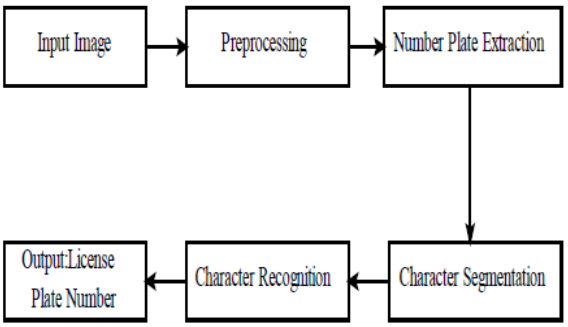

Figure 1: Basic works of ANPR System

In this system, the number plate is extracted from preprocessed vehicle's input image using techniques such as morphological operations, Sobel vertical edge detection, thresholding and connected component analysis. The input image is first of all preprocessed using iterative bilateral filters and adaptive histogram equalization. However, this system does not provide accurate results and the efficiency of the extraction is affected due to uneven illumination, blurred image and low resolution input image thereby increasing the computation time. The proposed system helps to resolve these issues.

The organization of the paper is structured as follows. The proposed method is described in section II. The results are

shown in the section III. Finally, conclusion and the future works are presented in section IV.

II. METHODOLOGY

In proposed system, number plate is extracted from the video rather than an image. But , when recognizing the number plate image from the video, unwanted frames causes confusion for recognizing the number plate. To address this problem, a memorability based frame selection algorithm that enables automatic selection of memorable frames for number plate feature extraction is introduced. Typically the video thus embeds large intrapersonal variations across multiple frames which significantly improves the recognition performance. The proposed work intends to do a number plate feature extraction by using the memorability based frame selection algorithm. Memorable frames should facilitate number plate recognition by providing the images that contain discriminative/unique information for feature extraction. In addition, to the inherent performance advantage in utilizing only a subset of frames instead of all the frames, the algorithm can avoid confusion for feature extraction and is also able to filter redundant or non-informative frames. Hence, the computation time for recognizing number plate from the video is lessened.

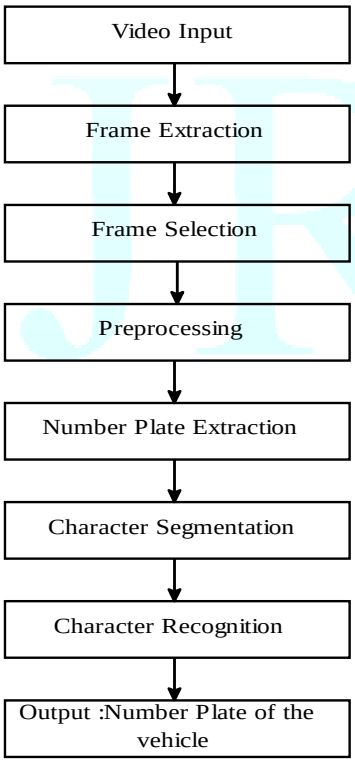

Figure 2: System Architecture

A. *Video Processing And Frame Selection*

Videos have plenty of information in the form of frames that can be utilized for feature extraction and matching. However, images in all the frames are not useful. Therefore, utilizing all the frames available in a video for recognition of the image does not necessarily improve the performance but significantly increases the computation time. Hence, a memorability based frame selection algorithm that enables automatic selection of memorable frames for number plate extraction is used.

B. *Frame Selection Algorithm*

Videos generally consists of numerous frames. Nonetheless, all of these frames may not be used for number plate recognition. Some frames are almost similar to each other, whereas some frames can have an image which is challenging to recognize. This may be due to illumination and some other variations in the image. Utilizing such frames for recognition can affect the performance. Therefore, it is worth having to select the best set of frames from a video to obtain accurate recognition. The proposed algorithm reckons the memorability by determining the feature richness of the image. To compute memorability score of the image, the input image I is preprocessed to be of a predetermined size which is then converted to the HSV (Hue, Saturation, Value) color mode. After conversion to HSV color mode, only Hue is considered for further processing to attain resilience towards illumination variations. Thereafter, the image is divided into equally sized overlapping windows of size 2 × 2 and visual entropy of each window is calculated. Visual entropy can be used to calculate the feature-richness of an image region. Hence, the weightage of all the frames are calculated and then some of the frames are chosen to have larger weights than the other frames. Here, the weights corresponds to the quality of the image. Thereafter, operations such as preprocessing, license plate extraction, character segmentation and character recognition is done for each of the selected frames. The one that produces the accurate results can be considered as the output image. Therefore, including memorability in frame selection can improve the recognition performance.

C. *Preprocessing*

Preprocessing is essential to promote high performance recognition. The main objective of pre-processing is to reduce the noise in the image and to enhance the contrast of the input image thereby boosting the processing speed. The captured input image is in RGB format. In pre-processing RGB image is converted into gray level image and then into binary image. Various filters are used to remove noise from the input image. The basic aim of filtering is to eliminate noise and distortion from the image. These noises can occur during capturing of an image using a camera and due to some weather conditions. In the proposed method iterative bilateral filter which is a non-linear filter is used for noise removal. It furnishes the mechanism for noise reduction while conserving the edges more efficiently than median filter.

D. *Candidate Plate Extraction*

The number plate extraction is considered very important in the ANPE system. A number of techniques have been proposed for locating the plate. To identify the correct region some features such as shape, size of the plate and aspect ratio are tested for all regions. The basic step in recognizing the number plate is to discover the plate size. The gray image is cropped whereby it will extract the smallest rectangle which will contain the edge of the number plate and

number plate itself. This process of cropping will highly enhance the speed of image processing as the space surrounding the plate is of no importance. Hence, localization of the number plate is performed. Besides, a canny edge detector is used to identify the edges or boundaries of objects within the extracted number plate image.

E. Character Segmentation

Given the number plate image, the goal of this phase is to segment all the characters holding on the features of the characters. Character segmentation is the process of isolating or segmenting the characters and numbers from the license plate image. Character segmentation plays a vital role in image processing. After extracting the Character images, some morphological operations are performed on the images. There are different factors that cause the character segmentation task little complicated, such as image noise, plate frame, rotation and illumination variance. A morphological process is used which examines the entire image for small connected elements and remove it. Then, dilation operation is performed on the image for separating the characters from each other if the characters are close.

F. Character Recognition.

After the separation of elements (characters and numbers), the final process is the identification of the characters and the numbers on a number plate. Before recognition algorithm is used the characters are refined .Then each character is fit to equal size necessary for template matching. To match the characters with the database, input characters must be of equal size with the database characters. Template matching can also be used which is an effective algorithm for character recognition. The character image is examined with the images in the database and the best similarity is measured. Optical character recognition is an algorithm used for the recognition of the characters. The OCR approach is based on pattern recognition principles which makes use of a template-matching algorithm. The shapes identified as possible characters of the process are binarized and scaled to match the size of the templates in a database, i.e. 42x24 pixels. Each shape is compared with all the characters in the database and the best match among them is selected.

III. RESULTS

The following figures were taken from the MATLAB results. Figure 3(a) shows the input image obtained from video processing. Figure 3(b) shows the gray scale image.

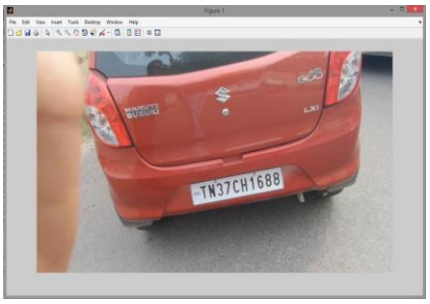

Figure 3 (a)

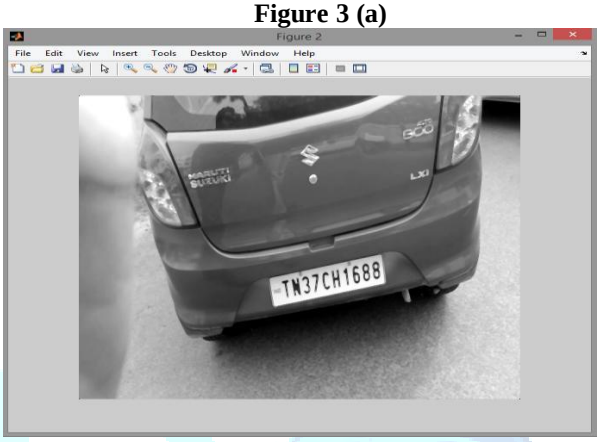

Figure 3 (b)

Figure 4(a) shows the candidate plate extraction and Figure 4(b) shows the result of applying the canny operator to the extracted number plate image

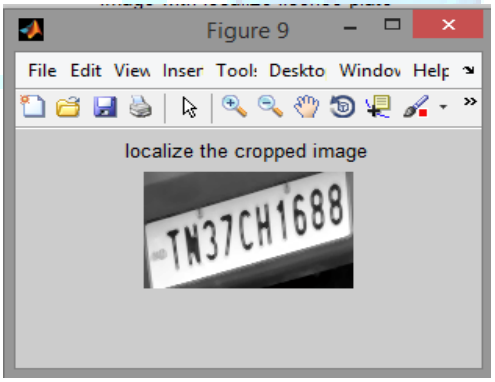

Figure 4 (a)

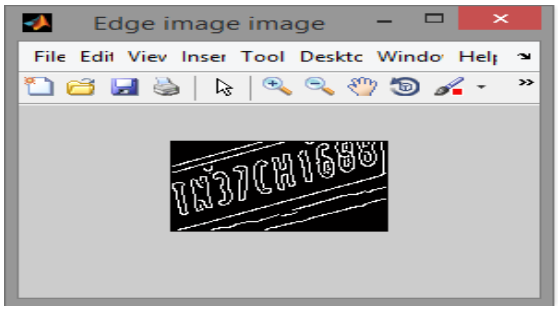

Figure 4 (b)

Figure 5 represents an image on which morphological operations such as erosion and dilation are applied

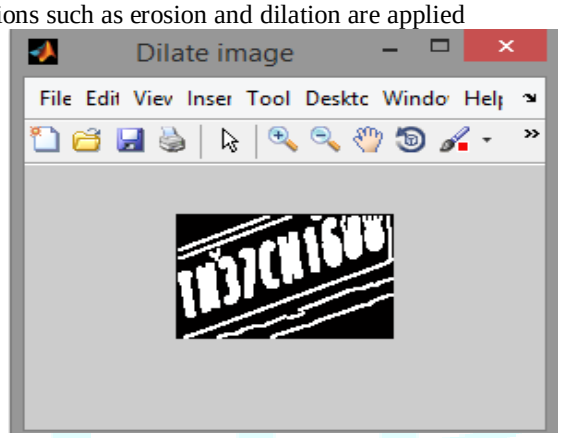

Figure 5

Figure 6 represents the result of character recognition in which the optical character recognition algorithm is used to identify the characters in the number plate.Figure 7 represents the editable format in notepad.

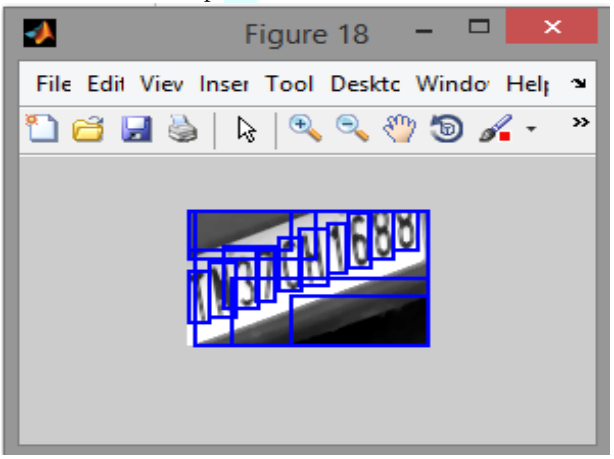

Figure 6

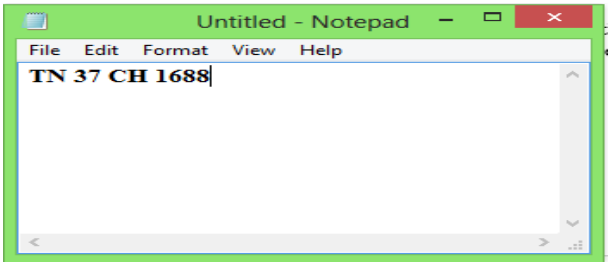

Figure 7

IV.CONCLUSION

Video processing is a prominent image processing technique to extract maximum information from a video. This technique is used for manipulating vehicle information from low- resolution surveillance videos. In spite of achieving an accuracy of 98% for certain tasks as sensitive as tracking stolen vehicles and monitoring vehicles for homeland security an accuracy of 100% cannot be achieved. Therefore, further optimization is demanded. In addition, to this, certain issues like stains, smudges, blurred regions and different font style and sizes need to be dealt with. This work can be further extended to reduce the errors caused by them.

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