Number Plate Recognition Using Segmentation

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Abstract

Automatic Number Plate Recognition (ANPR) is a real time embedded system which identifies the characters directly from the image of the license plate. It is an active area of research. Vehicle number plate recognition (VNPR) has been intensively studied in many countries. Due to the different types of number plates being used, the requirements of an automatic number plate recognition system is different for each country. In this paper, a number plate localization and recognition system for vehicles in India is proposed. This system is developed based on digital images and can be easily applied to commercial car park systems for the use of documenting access of parking services, secure usage of parking houses and also to prevent car theft issues. The proposed algorithm is based on a combination of morphological operation with area criteria tests for number plate localization. Segmentation of the plate characters was achieved by the application of regionprops function in Matlab, labelling and fill hole approach. The character recognition was accomplished with the aid of optical characters by the process of Template matching.

Keywords: Vehicle number plate recognition, regionprops, optical character recognition.

1. Introduction

The purpose of this paper was to build a real time application which recognizes license plates from cars at a gate, for example at the entrance of a parking area. The system, based on regular PC with video camera, catches video frames which include a visible car license plate and processes them. Once a license plate is detected, its digits are recognized, displayed on the User Interface or checked against a database. The strategy of the project is to design

automatic system for opening a gate without mounting any signal transmitter on the car. Thus, the project is to investigate and construct an application whereby the system will recognize the Vehicle license plate at a gate entrance of the parking lot. The system will be based on a personal computer and software packages available, MATLAB program and a digital camera, which help to capture the images of the vehicle license plate. We will conduct a research and developed a system that is able to extract the vehicle license plate. Next, we also need to create an algorithm to train and identify the vehicle license plate for the purpose of recognition. The general algorithm involves the following steps:

☐ Image Processing: The image captured is pre-processed and reduction in the contrast.

☐ Plate localization and extraction: To obtain the vehicle plate sub image.

☐ Character Segmentation/Recognition: Resample and threshold in order to isolate the license plate and vehicle license plate character. Then recognition of vehicle license late character.

☐Evaluating the performance of the algorithm and compare the input image with the database.

2. Related Work

The problem of automatic VNP recognition is being studied since the 90's. The early approaches were based on characteristics of boundary lines. The input image being first processed to enrich and enhance boundary line-information by using algorithms such as the gradient filter, and resulting in an image formed of edges. The image thus processed was converted to its binary counterpart and then processed by certain algorithms, such as Hough transform, to detect lines. Eventually,

couples of 2-parallel lines were considered as a plate-designate. Another approach was based on the morphology of objects in an image. This approach focuses on some salient properties of vehicle plate images such as their brightness, contrast, symmetry, angles, etc. Due to these features, this method could be used to detect the similar properties in a certain image and locate the position of number plate regions. The third approach was based on statistical properties of text. In this approach, text regions were discovered using statistical properties of text like the variance of gray level, number of edges, edge densities in the region, etc. This approach was commonly used in finding text in images, and could well be used for discovering and designating candidate number plate areas as they include alphabets and numerals. In addition, there have been a number of other methods relating to this problem focusing on detecting VNP using artificial intelligence and genetic algorithms. These systems used edge detection and edge statistics and then AI techniques to detect the location of the number plate-designate area. All of the systems discussed above have some kind of limitations for example they are plate size dependent, colour dependent, Work only in certain conditions or environment like indoor images etc. The method that we are proposing is independent of colour, size, location and angle of the number plate of the vehicle.

3. Proposed System

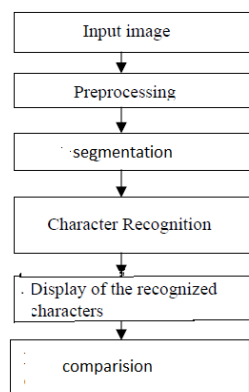Fig: 1 shows the Diagram of the proposed VNPR Process.

Fig. 1: Proposed VNPR Process

I   Input image

The initial phase of image processing for Vehicle License Plate Recognition is to obtain images of vehicles. Electronic devices such as optical (digital/video) camera, webcam etc can be used to capture the acquired images. For this project, vehicle images will be taken with a Panasonic FX 30 digital camera. The images will be stored as colour JPEG format on the camera. Next, we might

proceed in using the Matlab function to convert the vehicle JPEG image into gray scale format Input of this system is the image captured by a camera placed at a distance of 4-5metres away from the vehicle as shown in Fig 2.

Fig 2. Original image for recognition

II Pre-processing

The RGB image is then converted into a gray scale image for easy analysis as it consists of only two colour channels. Median filtering is then implemented for the effective removal of speckle noise, salt and pepper noise (impulsive noise). The aim of this process is to increase and improve the visibility of the image. Image Enhancement techniques consists process of sharpening the edges image, contrast manipulation, reducing noise, colour image processing and image segmentation as well. The gray image is then cropped which is a recognition process whereby it will extract the smallest rectangle which will contains the edge of the license plate and license plate itself. As the license plate surrounding is of no importance, this cropping process will highly increase the speed of image processing. The figure below shows the cropped image:

Fig 3.The cropped image.

III Character Segmentation

Segmentation is one of the most important processes in the automatic number plate recognition, because all further steps rely on it. in MATLAB, the function region props (for "region properties") provides a shortcut for determining many properties of a black and white or labelled image. Measure properties of image regions (blob analysis) the regionprops syntax is STATS = regionprops (L, *properties*), it measures a set of properties for each labelled region in the label matrix L.Positive integer elements of L correspond to different regions. For example, the set of elements of L equal to 1 corresponds to region 1; the set of elements of L equal to 2 corresponds to region 2; and so on. The return value STATS is a structure array of length max (L (:)). The fields of the structure array denote different measurements for each region, as specified by properties. Properties can be a comma-separated list of strings, a cell array containing strings, the single string 'all', or the string 'basic'. This table lists the set of valid property strings. Property strings are case insensitive and can be abbreviated.

'Area'	'EulerNumber'	'Orientation'
'BoundingBox'	'Extent'	'Perimeter'
'Centroid'	'Extrema'	'PixelIdxList'
'ConvexArea'	'FilledArea'	'PixelList'
'ConvexHull'	'FilledImage'	'Solidity'
'ConvexImage'	'Image'	'SubarrayIdx'
'Eccentricity'	'MajorAxisLength'	
'EquivDiameter'	'MinorAxisLength'	

If properties are the string 'all', regionprops computes all the preceding measurements. If properties are not specified or if it is the string 'basic', regionprops computes only the 'Area', 'Centroid', and 'Bounding Box' measurements.Fig.4 shows the segmented section of the cropped image by using regionprops.

Fig 4. Segmented section of the cropped image

IV Character recognition

It is employed for the purpose of conversion of images of text into characters. The goal of Optical Character Recognition (OCR) is to classify optical patterns (often contained in a digital image) corresponding to alphanumeric or other characters. The process of OC involves several steps including segmentation, feature extraction, and classification. Each of these steps is a field onto itself, and is described briefly here in the context of a Matlab implementation of OCR. examples of OCR applications are listed here. The most common for use OCR is the first item; people often wish to convert text documents to some sort of digital representation.

1. People wish to scan in a document and have the text of that document available in a word processor.
2. Recognizing license plate numbers.
3. Post Office needs to recognize zip-codes.

Before recognition algorithm, the characters are normalized. Normalization is to refine the characters into a block containing no extra white spaces (pixels) in all the four sides of the characters. Then each character is fit to equal size. Fitting approach is necessary for template matching. For matching the characters with the database, input images must be equal-sized with the database characters. The extracted characters cut from plate and the characters on database are now equal-sized.

The next step is template matching. Template matching is an effective algorithm for recognition of characters. The character image is compared with the ones in the database and the best similarity is measured. To measure the similarity and find the best match, a statistical method correlation is used. Correlation is an effective technique for image recognition which was developed by Horowitz. This method measures the correlation coefficient between a number of known images with the same size unknown images or parts of an image with the highest correlation coefficient between the images producing the best match.
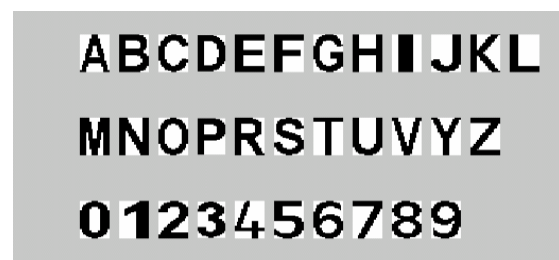

Fig.5 :. Figure 6.10 database characters.

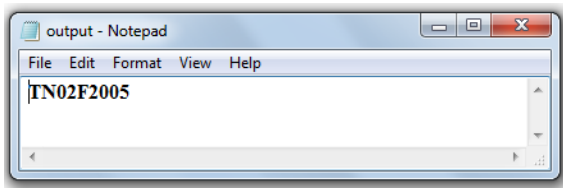The output of OCR on the segmented license plate shown above is:

Fig 6. The output of OCR on the segmented license Plate.

V Comparison

Database is a collection of information or data which it is being orderly organize, thus it can be accessed easily and updated. Database can be in the form of text, contents and images. Database is needed to make sure that the image space can contained enough characters which have been extracted and the vehicle license plated number stored in the notepad for the purpose of comparison. The database would be enlarged in order to improve the accuracy and better chances of obtaining the correct result. The class recognition will check if the computed ratio is correct. It will ignore the class if the image thresholding is too low. If the class has match correctly, it will be compare with data set in the database and provide an output if the image is recognized correctly. Characters are compared to determine whether the input image is authenticated or not. Which is done by comparing the recognised license plate with the database .the database contain the list of license plate which are authorised.comparision is done line by line and by checking every character in each line. If all characters are matched then message will come as "authenticate".

Results

The system's accuracy in locating the number plate is more than 98%. The problem encountered in the earlier systems in locating the number plate when vehicle bodies and their number plates have similar colors was overcome. Thereby achieving higher accuracy in number plate extraction step. As the fonts vary from one number plate to the other, ambiguous situation may arise in recognizing the characters 'G' and 'C', 'I' and '1', '7' and 'T' and alike since OCR template was developed for one particular font. But some of them were overcome by "character categorization" approach.

Table1.Results of the Test

Units of LPR System	Number of Accuracy	Percentage of Accuracy
Extraction of Plate Region	332/340	%97.6
Segmentation	327/340	%96
Recognition of Characters	336/340	%98.8

Conclusion

The development of the Vehicle license Plate Recognition System is quite successful Implemented using MATLAB version 7.5.
For this project, I have listed out the process report that needed to be done.
□ Read the colour image into Matlab
□ Manually crop the license car plate region from the colour image
□ Analyze the cropped image in its red, green blue frames
□ Convert the image from RGB to gray value.
□ Noise Reduction using median filter.
□ Extract each character and number from the image using segmentation techniques.
□ Training of the database.
□ Send the character and number to database for recognition
□ Results is to be displayed in Matlab
□ A GUI will be developed after the techniques has been tested.

Acknowledgements

Fig.7. Graphical User Interface for the Demo program

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