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Easy License Plate Detection and Recognition

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Abstract: ***Easy licence plate detection and recognition has a great role in the field of image processing and pattern recognition. One of the massive defects in licence plate recognition is poor quality of image by multiple factors like, differential climate condition and dark lighting. In this paper Images are captured in real time environment and saved into specific path. Text is extracted from binarized image using Tesseract OCR. Easy license plate detection and recognition allows the owner to change the registration certificate through e-mail confirmation and to identify whether the vehicle is taxi or not.***

1. Introduction

Easy licence plate detection and recognition is the process of detecting the number plates by using the character segmentation and extraction method. ELPR have different areas of applications such as finding lost vehicles, for troll collection, in police headquarters etc. Easy licence plate detection and recognition systems are mainly used in real time systems, and can be used in the areas with limited accessibility. Another factor is capturing the image from large distance also affect the quality of images. In faded street light and different background conditions also affect the poor quality of image in ELPR. Text detection provide low quality image as output before enhancement. It is true that we can't provide complete information due to different background conditions.

"The binarization effect produces low quality of images and provides loss of shapes, Tesseract OCR fails to identify the image character correctly before edge enhancement but same OCR identify the character after text enhancement and here we can state edge enhancement techniques provide better text detection and recognition rates."

The factors that affect the quality of images are by the following reasons (i) Illumination conditions during image capturing (ii) Stained license plates and non-license plate characters printed on vehicles, and (iii) Blur occurrencedue to distance. Where the text detection method helps in text detection in natural scene images, fails to detect complete license plate numbers due to low quality image (low contrast).

ELPR uses many enhancement techniques one of them is image histogram equalization which provide high quality images .we can summarize that enhancement technique play an important role in license plate recognition for determining good results.

2. Related Works

Number of methods have been proposed over last few decades. Those methods which focus on the inaccuracies that found on the existing methods. As a result we developed a model which comprises of binarization, character segmentation and character extraction.

ChangchunLiuan and MaxQ.- H.Meng[1] proposed A Novel License Plate Location Method Based On Wavelet Transform And Emd Analysis. In this paper, by applying wavelet transform to an image and by projecting the acquired detail information, a wave crest which indicates position of a license plate will be generated in it.]. In order to search for the desired wave crest, EMD analysis is utilized to deal with the projection data. Compared with traditional methods, the technique presented in this paper is much less restrictive. It can detect the license plate under various conditions such as vehicles of different countries, images taken under different illumination conditions, distorted, blurry or dirty license plates. V. Tadi, M. Popovic and P. Odry[2] proposed a paper on Fuzzified Gabor Filter For License Plate Detection. In this paper discussing about the image filtering using the gabor filter which is a common procedure which is used for the extraction of spatially localized spectral character images of interest.

3. Proposed Model

Elements of typical ELPR systems:

- **Camera(s)** - that take the images of the car (front or rear side)
- **Illumination** - a controlled light that can bright up the plate, and allow day and night operation. In most cases the illumination is Infra-Red (IR) which is invisible to the driver.
- **Computer** - normally a PC running Windows or Linux. It runs the ELPR application which controls the system, reads the images, analyzes and identifies the plate, and interfaces with other applications and systems.
- **Software** –Software are important very much in ELPR. The code for extraction and binarisation play a better role.
- **Hardware** - various input/output boards used to interface the external world (such as control boards and networking boards)

There are a number of possible difficulties that the software must be able to cope with. These include:

1) Poor image resolution, due to low quality camera and also due to long range image captures.
2) Blurred images.
3) Due to reflection and shadows.
4) Dirt on plate and presence of tow bar.
5) Different font and styles in characters

While some of these problems can be corrected within the software, it is primarily left to the hardware side of the system to work out solutions to these difficulties. Increase in height of the camera may avoid problems with objects obscuring the plate and the increased skew of the plate.

On some cars, tow bars may obscure one or two characters of the license plate. Bikes on bike racks can also obscure

the number plate. When used for giving certain vehicles access to an unauthorised or barricaded area, the decision may be made to have an acceptable error rate of one character. This is because the rate of an unauthorized car having such a similar license plate is seen as quite small. Where, this level of inaccuracy would not be acceptable in most applications of an ANPR system.

Core Technology:
If you scan a document into your PC and then open it in a word processor you cannot edit or alter it in any way. This is because it is simply one bitmap made up of thousands of individual pixels. However there is software available, frequently scanners that can convert these groups of pixels into characters. This is Optical Character Recognition (OCR), which scans each group of pixels and estimates whether or not it could be a letter and replaces the pixels with the ASCII code for the letter. For instance the ASCII code for the lower case 'a' is 01100001. So, the software scans the whole document and produces a page of letters exactly the same as though you had typed them in, which can be edited or manipulated in any way.

Optical character recogniser is the basic technology used in ANPR and provides the capability to store and sort data. ANPR cameras need to be a certain type and set up within certain important parameters as will be described later.

As a vehicle reach close by the camera the software takes a series of 'snapshots' and stores them in a file. When the number plate is of sufficient size for the OCR software the frame is scanned and the registration number is converted to ASCII code and held in a list. This continues for a variety of images according to the position and speed of the vehicle. The list is scanned for similarities and a 'favourite' selected to retain. The system would typically scan and compare 10-15 images, with 5 being considered the minimum for high accuracy.

This is the principle of the software we are describing; some systems only take one image at a certain position.

This then, is the start of the ANPR capture and is totally dependent on the correct set up of camera, lens, illumination, angle of view and configuration. Get one wrong and you have a disappointed customer who won't pay the bill.

At this stage we are concentrating on the number plate capture but there are many other aspects to be considered for a completely integrated system, which will be discussed later. Where the ANPR capture is determined to be monochrome.

Camera Positioning:
Camera is positioned in order the arriving vehicle scenario. Many systems will not function with more than more 1 or 2 degrees of horizontal skew or vertical rotation.

The camera is to be positioned accurately which is an important consideration for satisfactory operation of an ANPR system. This can vary the percentage of recognitions to number of vehicles from 30% or 40% to near on 100%. The camera location depends on several factors, such as:

Single camera covering a barrier entrance:
The best position for camera setup is 10m above the incoming or approaching vehicle.

Single camera covering one lane:
This could be a pole mounted unit about from 18M to 30M from the vehicle.

Single or multiple cameras covering multiple lanes:
The input from ANPR provider is required for this special application.

Town centre cameras already installed:
Usually the cameras will not have been properly setup with ANPR in mind and so the positioning will not be optimised, they will generally be colour with no infrared illumination and will operating with the shutter speed set to 1/50th.

The first thing to address is the shutter speed if it is adjustable. The best would be if the speed can be controlled by remote, if not each camera needs to be visited and the speed should be determined manually. The optimum setting is to 1/1000th. Settings may differ from varying speed of approaching vehicle. Note that all these settings will affect the low-light capability of the cameras and a compromise may be required.

Another consideration is that the camera positions and heights would not be at the optimum for ANPR. Special attention must be paid to the skew in license plate and rotation and a guaranty obtained that an acceptable percentage of recognitions will be achieved.

Example flow diagram for ELPR system:

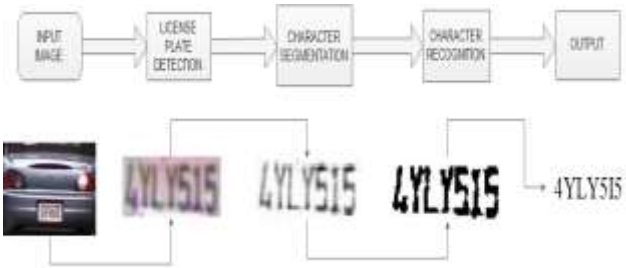

Figure 1: Flow Diagram

Steps followed:
Number plate (shown in fig: 1) recognition basically consists of three concrete steps namely:
1) Number Plate Extraction.
2) Character Segmentation.
3) Template Matching.

However, these steps are further divided into a series of other steps whose working is as followed:

1) Loading an RGB image:
The image whose number plate recognition is (shown in fig: 1.1) to be done is loaded.

Figure 1.1: loading an image

2) Greyscale conversion:
This RGB image is (shown in fig: 1.2) converted to greyscale image using cvCvtColor() function.

Figure 1.2: Greyscale Image

3) Binarization
This image is (shown in fig: 1.3) then converted to binary using adaptive thresholding.

Figure 1.3: Binarized Image

4) Edge detection
Dilated image is (shown in fig: 1.4) subtracted from the original image to get the edges

Figure 1.4: Edge Detected Image

5) Plate region extraction:
Plate region is (shown in fig: 1.5) found out by passing a rectangular image over the previous using cvMatchTemplate() function.

Figure 1.5: Extracted Plate Region

6) Character segmentation:
Characters are segmented from the number plate image which is then used for template matching.(fig:2.1)

Figure 2.1: Segmented Character

7) Template matching:
Segmented characters are template matched with the templates of each character and the number plate is identified as a string. (Fig: 3.1 and Fig: 3.2)

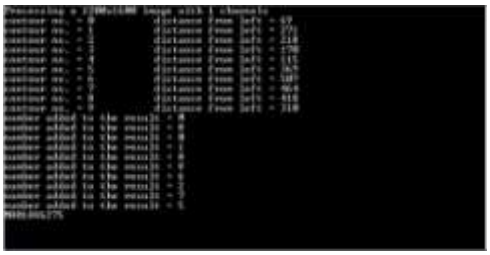

Figure 3.1: Output in string form

Figure 3.2: Output after Template Matching

4. Results and Discussions

The Easy licence plate model is compared with the text detection and binarization methods to show that enhancement model is useful in improving text detection and recognition results. To show that method is superior to the existing methods, the Easy licence plate detection and recognition method with the state-of-the-art license plate detection and recognition. Component analysis and thresholding for license plate detection and features extraction at character level with a neural network classifier for recognition. Since the method depends on thresholding and binarization, it requires high contrast images for achieving good results.

The Easy licence plate detection and recognition method achieves the best results compared to the existing methods for both license plate detection in terms of precision, f-measure, and recognition in terms of recognition rate. The reason of the existing methods to report poor results is that the methods suffer from inherent limitations that connected component analysis, country specific features and high contrast images. On the other hand, method does not have any specific constraints based on country and dataset. The methods including the method report To show the effectiveness of the Easy licence plate detection and recognition model, experiments on text detection and recognition for the enhanced images through several text detection and binarization methods. In addition, it is also confirmed that the model is competitive to super resolution. However, as per the low results from images are compared to binarization. This is because the license plate detection and recognition methods focus on upper case letters and numerals but not lower case letters. However, the method is consistent for all the three datasets with few differences. Hence the existing methods license plate detection as a pre processing step for recognition, the reference is same for both license plate detection and recognition. In case, Easy licence plate detection and recognition model two separate methods form license plate detection and recognition.

5. Conclusion

A new Easy licence plate detection and recognition model for enhancing license plate image quality to improve the performances of license plate detection and recognition methods. The Easy licence plate detection and recognition model works based on the fact that the real and complex number power of derivative has the ability to study the abrupt changes affected by multiple factors for license plate images.

Recognition method report poor results compared license plate detection. Therefore, work towards this would be in the future target by introducing deep learning.

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