IOSR Journal of Computer Engineering (IOSRJCE)
ISSN: 2278-0661 Volume 2, Issue 2 (July-Aug. 2012), PP 37-38
www.iosrjournals.org

Lucrative Method for License Plate Recognition

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Abstract : *Recent research initiatives have addressed the need for improved performance of license plate recognition accuracy that would profit many applications, ITS in particular. Different image processing techniques have been implemented for this purpose specifically edge detection, binarization, segmentation algorithm and tesseract. Each of these steps has its own strengths and weaknesses and it has been proved that using each of these methods individually does not provide a suitable solution that answers today's character recognition needs. This project endeavors to provide improved license plate recognition accuracy by using a novel approach that involves integrating image processing techniques and tesseract according to some constraints. Experimental results prove that this integration provides better recognition accuracy than using traditional techniques for license plate recognition.*

Keywords – *character, image processing, license plate, recognition, tesseract*

I. Introduction

LPR (License Plate Recognition) is an image-processing technology used to identify vehicles by their license plates. This technology has a wide range of applications, which uses the extracted plate number and optional images to create automated solutions for various problems. LPR systems are widely implemented for tracking vehicles during traffic signal violations and related applications with huge saving of human energy and cost. In real time; factors such as moving vehicles, position invariance of license plates , poor illumination creates difficulty in reading license plate images with accuracy.

Automatic license plate localization and recognition of characters has been an active area of research for long. There have been many methods proposed for extracting license plate characters using image processing techniques. Hontani et.al. [1] proposed a method for extracting characters without prior knowledge of their position and size in the image. Locating position of license plate in an image fastens the process of detection. Yang et al. [2] used a fixed background color to find the possible license plate regions which results in poor localization rate. For recognition of characters methods such as neural network [3], template matching [4] have been used, which is a time consuming operation. The stages for detecting license plate regions must be fast and accurate in an LPR system. The formulated method is based on localizing vertical edge features and recognition of license plate characters using open source technology. This paper describes an enhanced LPR approach, for Vehicle Identification and Recognition using open source technology for image processing and Google's Tesseract OCR. The purpose of reduced time consumption in locating license plates with edge detection methods and recognition of license plate characters has been achieved with improved accuracy.

The method put forth for license plate recognition starts with image data set collected as a part of a demonstration project on Automated Red Light Violation Detection system for a monitoring traffic in India. The operation continues with localization of license plate candidate regions. There after resulting regions are binarized. Character segmentation is performed enhanced images to extract individual characters. Finally, segmented characters are sent to recognition engine for identification of license plate characters and numbers. In the following sections, each operation and related experiments are presented in a detailed way.

II. License plate localization

This step is the preprocessing step for license plate identification. The datasets used for the experiment are 24-bit color bitmap images captured through CCD camera with a resolution of 346 x 231 pixels. The images were captured in an unconstrained outdoor environment with varying light conditions, pollution levels, wind turbulences and vibrations of camera.

2.1 Localization

The first preprocessing stage deals with locating the position of license plate with image under consideration. Edge detection technique is used for band and plate clipping. For gray scale conversion, from 24-bit color value of each pixel, the R, G and B components are separated and the 8-bit gray value is calculated using the formula:

$$Gray(i, j) = 0.59 * r(i, j) + 0.29 * g(i, j) + 0.11 * b(i, j) \quad (1)$$

where, (i,j) indicates the location of a pixel.

The input image is then convolved with a vertical edge detection sobel kernel, followed by thresholding to emphasize the license plate vertical edges. Vertical projection of license plate image is computed by identifying the occurrences of vertical edges at certain points of license plate band clipping. Again a sobel

kernel for horizontal edge detection and a thresholding binarization is applied for plate clipping. The horizontal projection based on the magnitude of points at certain region of license plate image is then used to simplify the input for the next step. Too broad edges are eliminated in plate clipping.

2.2 Binarization

Image binarization converts an image of up to 256 gray levels to a black and white image. Otsu thresholding is applied on binarized image. The calculated optimum threshold separates the two classes of pixels (foreground and background) based on histogram at each intensity level. For good segmentation results, skew correction is performed on license plate using radon transform. The resultant output is then processed for segmentation.

2.3 Segmentation

This step is the most important step in license plate recognition because all further steps rely on it. The processed license plate image is segmented by computing horizontal and vertical projection. The license plate is segmented by counting number of black pixels serially. The horizontal projection of license plate characters is determined with running count of black pixels in each row. Then black pixels are grouped together for character recognition. In Fig.1, horizontal segmented license plate is shown.

Now vertical projection is carried out in each column by counting the number of black and white pixels. The black pixels are thereby grouped together for extracting each character from horizontal segmented license plate image. The white space between each character element is known by amount of black pixels in the neighborhood of white pixels. Each character from license plate image is obtained separately as shown in Fig.2.

Figure 1. Horizontal segmented license plate

Figure 2. Vertical segmented license plate characters

III. License plate character recognition

Initially, a neural network approach was used for character recognition. The initial results were not promising. As the results were not sufficient for license plate identification, launching neural network for identifying each character consumed a considerable amount of time. As a second approach, the traditional method template matching was used to match the characters. The results were not promising.

Thus a robust and efficient ocr engine is used which is a totally different research subject and requires a lot of expertise. This external recognition engine is utilized for identifying the segmented characters which is a open source optical character recognition (ocr) engine called tesseract.

Improved recognition accuracy was obtained with the use of google's tesseract engine, as teseract engine looked at more history and examined more states than NN models. Also, the above method was found as not subjected to the complexity associated with the number of characters generated. A total of 200 vehicle images captured from a metro city have been tested. The proposed license plate recognition algorithm showed a high accuracy rate of 90%.

IV. Conclusion

The proposed system improved the license plate recognition by integrating all three modules: Localization, Segmentation and Character recognition according to certain constraints. License plate images were preprocessed and plate location was identified. Skew correction was performed on license plates and characters were segmented using horizontal and vertical projection algorithm. Finally, Tesseract was applied to recognize segmented license plate characters. The system is designed for standard Indian license plate recognition. Accuracy rates improved to 92% with the experiment performed on data sets acquired in different outdoor conditions. The proposed model can be easily extended to a completely automated system.

This paper is formulated to present an open source solution for recognition of license plate. Tesseract OCR was applied and analyzed on the proposed system. Considering the results, Tesseract OCR has better ability to recognize license plate characters when compared to usually used methods like template matching and neural network.

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