International Journal on Applications in Engineering and Technology
Volume 7: Issue 4 : December 2021, pp 12 – 16 www.aetsjournal.com ISSN (Online) : 2455 - 0523

AUTOMATED IMAGE ANALYSIS FOR INSURANCE VERIFICATION THROUGH LICENSE PLATE RECOGNITION

SARAVANA KUMAR . S , K . SELVAKUMAR , N . KADHAR BASHA

Abstract— Automatic Number Plate Recognition is a cutting-edge image processing technology employed to identify vehicles through their number plates. The primary aim is to create an efficient system for both automatic vehicle authorization and insurance verification by leveraging vehicle number plates. The developed system begins by detecting the vehicle and subsequently capturing its image. Image segmentation techniques are employed to extract the region containing the vehicle's number plate. Optical character recognition is then utilized to recognize the characters on the plate. The resulting data is subsequently compared with records stored in a database, enabling the retrieval of specific information such as the vehicle owner's details, place of registration, address, and insurance information. The system has been successfully implemented and rigorously tested using real-world images. The experimental results demonstrate the system's capability to accurately detect and recognize vehicle number plates while simultaneously verifying insurance information from authentic images. This robust system holds great promise for enhancing vehicle identification and insurance validation processes.

Keywords--Image acquisition, Preprocessing (Gray scale & Bilateral filtering), Plate region extraction (Edge detection), Segmentation of Character (Optical Character Recognition), Character Recognition, Verifying Insurance Details

I. INTRODUCTION

Automatic Vehicle Number Plate Recognition Systems are utilized frequently for access control in stolen car detection, traffic control, automatic toll collection. Number plates are used to identify the vehicles. When a vehicle number plate is automatically recognized and information is stored in database. Automatic Number Plate Recognition (ANPR) algorithms are generally divided in five steps including verifying insurance details: (1) Preprocessing (2) Number plate region extraction (3) Character segmentation (4) Character recognition (5) Insurance Verification. The first step to capture image of vehicle and Convert RGB Colored Image to Binary Image or Gray Scaled image format than given Gray Scaled image to filter the real image using Bilateral Filtering. Then Second Step to plate region extraction is a filtered image to edge detection for finding the edges in number plate on real image and we extract the plate number using (OCR) Optical Character Recognition. Then Third step to Character Segmentation is a process of segment each character to be find accuracy and efficiently for recognition of character.

Then next step to character recognition is a process of recognize the plate number and specific information are stored in the database server. Finally, the resulting data is then used to compare with the records on a database so as to come up with the specific information like the vehicle owner, place of registration, address, insurance information.

II. PROPOSED SYSTEM

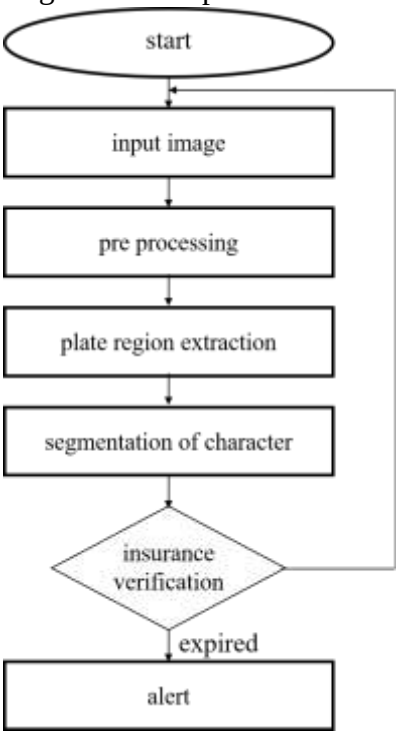
The automated system is tailored for the recognition of Indian vehicle license plates and simultaneous insurance verification. Its primary aim is to expedite the insurance verification process for traffic police while mitigating fraudulent activities attempting to evade authorities. The system operates in real-time, capturing input from the front camera. Through image processing techniques, the system detects and extracts license plate information. This identified number plate is then cross-referenced with a database to promptly verify

Saravana Kumar S , Faculty of Information Technology, Dhanalakshmi Srinivasan Engineering College, Tamil Nadu, India

K.Selvakumar , Professor, Department of IT, Faculty of Engineering and Technology, Annamalai University, Chidambaram

N.Kadhar Basha , Faculty of Information Technology, Dhanalakshmi Srinivasan Engineering College, Tamil Nadu, India

the insurance status, determining whether it is expired or current. This innovative solution not only enhances the efficiency of insurance verification but also contributes to increased road safety and law enforcement effectiveness by minimizing delays and preventing fraudulent practices.



1) Pre Processing

In This process is capture vehicle image Using ANPR and stored the database server on real image storage. To detect vehicle number plate use image binarization to convert color image to gray scale image. Some plate segmentation algorithms are based on color segmentation.

2) Grayscale Conversion

After the preprocessing of image grayscale conversion of the image has to be done so that further image processing becomes easier.

Figure 1: Grayscale Image

Grayscale conversion of image considers the shadow and light intensity in the image. This grayscale image will be used be used the purpose of localizing the number plate.

3) Bilateral Filtering

Bilateral filter is a non-linear, edge-preserving, and noise-reducing smoothing filter for images. It replaces the intensity of each pixel with a weighted average of intensity values form nearby pixels. This weight can be based on a Gaussian distribution. Crucially, the weights depend not only on Euclidean distance of pixels, but also on the radiometric differences. This preserves sharp edges.

The bilateral filter is defines as

$$I^{\text{filtered}}(x) = \frac{1}{W_p} \sum_{x_i \in \Omega} I(x_i) f_r(\|I(x_i) - I(x)\|) g_s(\|x_i - x\|),$$

and normalization term, W_p, is defined as

$$W_p = \sum_{x_i \in \Omega} f_r(\|I(x_i) - I(x)\|) g_s(\|x_i - x\|)$$

Where

I^{filtered} is the filtered image;

I is the original input image to be filtered;

x are the coordinates of the current pixel to be filtered;

Ω is the window centered x, so x_i **€ Ω**is another pixed;

f_r is the range kernel for smoothing differences in the intensities (this function can be a Gaussian function);

g_s is the spatial kernel for smoothing differences in coordinates.

Most of the number plate detection algorithms fall in more than one category based on different techniques. To detect vehicle number plate following factors should be considered:

1) Plate size: a plate can be of different size in a vehicle image.
2) Plate location: a plate can be located anywhere in the vehicle.
3) Plate background: A plate can have different background colors based on vehicle type. For example, a government vehicle number plate might have different background than other public vehicles.

4) Screw: A plate may have screw and that could be considered as a character.

Figure 2: Filtered Image

4) Plate Region Extraction

A. Edge detection

Edge detection is fundamental method for feature detection or feature extraction. In general case the result of applying edge detection of algorithm is an object boundary with connected curves. It becomes very difficult to apply this method to complex images as it might result with object boundary with not connected curves. Edge Detection algorithm/operators such as Canny are used for edge detection. Canny edge detector operator was applied to find out the transition points The Canny edge detector uses a filter, which is then based on Gaussian smoothing's first derivative to eliminate the noise. The canny edge detector operator used 3 X 3 matrix to accomplish this task. Based on this information transition points region is determined. The edge map is used to find transition points between black and white colors.

Figure 3: Plate Region Extraction

B. Character Segmentation

The number plate segmentation algorithm is a four-step procedure including median filtering, adaptive thresholding, component labeling and region growing and segmentation and normalization to remove noise, for binarization of image, to label the pixel according to color value and to segment the plate of 15 X 15 pixel size. This procedure selects the optimal level for thresholding depending on the intensity levels of each image. Remove impurities larger and smaller than the measurements of a character through the characteristics of each region and morphological operations. The character segmentation process consists of character height estimation, character width estimation. Character height estimation contains three parts: color reverse, vertical edge detection and horizontal projection histogram. Color reverse is used to make color of license plate characters as black by using statistical analysis of edges. Vertical edge detection is used to detect finalized number plate.

Figure 4: Character Segmentation

C. Character Recognition

Optical Character Recognition (OCR) aims to categorize optical patterns within digital images, specifically alphanumeric characters. Following the extraction process and filtering, the identified character is compared against pre-defined characters. These predefined characters encompass the data set of Alphabets A-Z and numeric characters 0-9, represented as images. Utilizing these image templates, a matching process is executed with the segmented characters from the number plate. OCR technology plays a crucial role in automating character recognition tasks, enabling efficient extraction and interpretation of textual information from images, particularly useful in applications such as license plate recognition systems.

D. Template Matching

Template Matching is one of the most common classification methods. In Template Matching, the features that the classification is based on are the individual pixels. An image is compared with

predefined images, which are referred to as templates. OCR is the mechanical or electronic translation of images of handwritten or typewritten text (usually captured by a scanner) into machine-editable text. The procedure consists of two important steps: training and recognition.

Figure 5: Character Recognition

E. Insurance Verification

In this process is specific information like vehicle owner, Insurance is compared/verify to the database server with help of give vehicle number and image storage. Finally verify the insurance details. If expired insurance alert passed the relevant vehicle owner or otherwise insurance is valid not shown in the alert.

III. EXPERIMENTAL RESULTS

In order to evaluate the success of the proposed method 50 vehicle image samples were checked. As a result, 48 in 50 were correctly detected and 50 in 50 were retrieved insurance information.

TABLE 1 EXPERIMENTAL RESULTS

No. of sample inputs	50
No. of correct detection	48
Percentage of correct detection	96%
No. of vehicle retrieval	50
Percentage of vehicle retrieval	100%

IV. CONCLUSION

An algorithm for vehicle number plate extraction, character segmentation and recognition are presented, Database of the image consists of images with different size, background, illumination, camera angle, distance etc. The experimental results show that, number plates are extracted faithfully based on vertical edge detection with success rate of 96%. The success rate achieved for vehicle information retrieval is 100%.

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