Automatic License Plate Recognition For Ambigious Character Using Template Matching With Fuzzy Classifiers

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Abstract — Automatic license plate recognition (ALPR) is the extraction of vehicle license plate information from an image or a sequence of images. The extracted information can be used with or without a database in many applications, such as electronic payment systems (toll payment, parking fee payment), and freeway and arterial monitoring systems for traffic surveillance. The illuminated images are better preprocessed to get the exact segmentation of license plate information. To deal with the illumination problem, good preprocessing methods (image enhancement) should be used to remove the influence of lighting and to make the license plate salient.

Keywords — Automatic license plate recognition, Template matching, Fuzzy Classifier, Image dilation and Erosion

I. INTRODUCTION

Automatic license plate recognition (ALPR) plays an important role in numerous real-life applications, such as automatic toll collection, traffic law enforcement, parking lot access control, and road traffic monitoring. ALPR recognizes a vehicle’s license plate number from an image or images taken by either a color, black and white, or infrared camera.

It is fulfilled by the combination of a lot of techniques, such as object detection, image processing, and pattern recognition. ALPR is also known as automatic vehicle identification, car plate recognition, automatic number plate recognition, and optical character recognition (OCR) for cars. The variations of the plate types or environments cause challenges in the detection and recognition of license plates. They are summarized as follows.

1) Plate variations:
   a) location: plates exist in different locations of an image;
   b) quantity: an image may contain no or many plates;
   c) size: plates may have different sizes due to the camera distance and the zoom factor;
   d) color: plates may have various characters and background colors due to different plate types or capturing devices;
   e) font: plates of different nations may be written in different fonts and language;
   f) standard versus vanity: for example, the standard license plate in Alberta, Canada, has three and recently (in 2010) four letters to the left and three numbers to the right, as shown in Fig. 1(a).
   Vanity (or customized) license plates may have any number of characters without any regulations, as shown in Fig. 1(b);
   g) occlusion: plates may be obscured by dirt;
   h) inclination: plates may be tilted;
   i) other: in addition to characters, a plate may contain frames and screws

Fig.1.(a) Standard Alberta license plate. (b) Vanity Alberta license plate.

2) Environment variations:
   a) Illumination: input images may have different types of illumination, mainly due to environmental lighting and vehicle headlights;
b) Background: the image background may contain patterns similar to plates, such as numbers stamped on a vehicle, bumper with vertical patterns, and textured floors. The ALPR system that extracts a license plate number from a given image can be composed of four stages. The first stage is to acquire the car image using a camera. The parameters of the camera, such as the type of camera, camera resolution, shutter speed, orientation, and light, have to be considered. The second stage is to extract the license plate from the image based on some features, such as the boundary, the color, or the existence of the characters. The third stage is to segment the license plate and extract the characters by projecting their color information, labeling them, or matching their positions with templates. The final stage is to recognize the extracted characters by template matching or using classifiers, such as neural networks and fuzzy classifiers. Fig. 2 shows the structure of the ALPR process. The performance of an ALPR system relies on the robustness of each individual stage.

II. License Plate Extraction

The input to this stage is a car image, and the output is a portion of the image containing the potential license plate. The license plate can exist anywhere in the image.

Instead of processing every pixel in the image, which increases the processing time, the license plate can be distinguished by its features, and therefore the system processes only the pixels that have these features. The features are derived from the license plate format and the characters constituting it.

License plate color is one of the features since some jurisdictions (i.e., countries, states, or provinces) have certain colors for their license plates. The rectangular shape of the license plate boundary is another feature that is used to extract the license plate.

The existence of the characters can be used as a feature to identify the region of the license plate. Two or more features can be combined to identify the license plate. In the following, the existing license plate extraction methods based on the features are categorized.

A. License Plate Extraction Using adaptive histogram equalization

Retinex filtering:

Here the illumination levels are studied and then the threshold operated values are used to filter the image based on the non-illumination classified pixels.

The Retinex filtering is used to remove the noises when the vehicle in the lighting conditions such as vehicle headlights or sunlight conditions. The example images in the different conditions are given.

It removes the illumination regions from the vehicle images based on the non-illuminated regions.
B. License Plate Extraction Using Projection Profiles

In projection profile method, two types of projections are carried out. There are horizontal and vertical projections.

This method project the binary extracted license plate vertically to determine the starting and the ending positions of the characters, and then project the extracted characters horizontally to extract each character alone along with noise removal and character sequence analysis, vertical projection is used to extract the characters.

C. License Plate Extraction Using Cross Correlation

The cross correlation is used to find license plates. The cross correlation is similar to the convolution of the two function such as noises. This method reduces the noises by adjusting the intensity value of the noises.

III. LICENSE PLATE SEGMENTATION

The isolated license plate is then segmented to extract the characters for recognition. An extracted license plate from the previous stage may have some problems, such as tilt and non-uniform brightness. The segmentation algorithms should overcome all of these problems in a preprocessing step.

A. License Plate Segmentation Using Pixel Connectivity

Segmentation is performed by labeling the connected pixels in the binary license plate image. The labeled pixels are analyzed and those which have the same size and aspect ratio of the characters are considered as license plate characters.

**Binary Image area opening**

Morphologically open binary image (remove small objects). It removes from a binary image all connected components (objects) that have fewer than given pixels, producing another binary image.

The basic steps are

1. Determine the connected components
2. Compute the area of each component
3. Remove small obje

**Fig 3. Example images in the different condition. (a) Complex scenes. (b) Various environments. (d) Damaged license plates**

Adaptive histogram equalization:

Contrast increment is achieved with perfect level of adaptive change in equalized value.
IV. CHARACTER RECOGNITION

The extracted characters are then recognized and the output is the license plate number. Character recognition in ALPR systems may have some difficulties. Due to the camera zoom factor, the extracted characters do not have the same size and the same thickness. Resizing the characters into one size before recognition helps overcome this problem. The characters’ font is not the same all the time since different countries’ license plates use different fonts. Extracted characters may have some noise or they may be broken. The extracted characters may also be tilted. There are two techniques used, they are

1. Template Matching
2. Fuzzy Classifier

A. Character Recognition Using Raw Data

Template matching is a simple and straightforward method in recognition. The similarity between a character and the templates is measured. Template matching is a process of matching the positions of the character with the templates.

The template that is the most similar to the character is recognized as the target. Most template matching methods use binary images because the grey-scale is changed due to any change in the lighting. Template matching is performed after resizing the extracted character into the same size. The different styles of characters and numbers are stored as a templates.

B. Character Recognition Using Fuzzy Classifier

Fuzzy classifier is an algorithm that assigns a class label to an object, based on the object description. It is also said that the classifier predicts the class label. Fuzzy classifier the clustering technique is used to group the objects. Fuzzy classifier is a fuzzy set that contains 0 and 1 that means these values are assigned based on matching.

V. CONCLUSION

In this project, demonstrate the improvement of the license plate recognition. The vehicle image is captured by using infrared camera. For license plate extraction, adaptive histogram equalization is used and the characters are segmented by using pixel connectivity and binary area opening. Finally the characters are recognized by using template matching and fuzzy classifier.

VI. REFERENCES


