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Proposed Method to Identify the Vehicle Registration Plate by Coarse-To-Fine Strategy of Edge Detection Technique

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Abstract: ***Edges contains some of the most useful information in an image. In an image, the edges can be used to measure the size of objects; to isolate particular objects from their background; to recognize or classify objects. The registration plate is one of the key steps in vehicle recognition system, the positioning accuracy is direct impact on the effect of registration plate recognition. In this paper, for the plate image that is under different backgrounds and lighting conditions, a Vehicle Registration Plate using coarse-to-fine strategy based on Edge detection technique was proposed. The experiments results show that the algorithm with high accuracy and have good practical value.***
Keywords:

I. INTRODUCTION

The exponentially increasing demand of multimedia systems and the distribution of large variety of digital image data almost in all fields demands the automation methods for further operations. Vehicle registration plate recognition (LPR) is one form of automatic vehicle identification (AVI), which not only recognizes and counts vehicles, but also distinguishes them as a unique. LPR has many applications in traffic monitoring fields. It can save time and alleviate congestion by allowing motorists to pass toll plazas or weigh stations without stopping. It can save money by collecting and processing vehicle data without human intervention. It can also improve safety and security by helping control access to secured areas or assisting in law enforcement. Registration plate extraction is the key step within a registration plate recognition system, which influences the accuracy of the system significantly. Some approaches to registration plate extraction in color image are presented because registration plates have appointed colors in their backgrounds and characters [1] [2]. However, colors of registration plates in images vary greatly due to different light conditions under which the images are taken, and vehicles may have similar color to the background of registration plate. Thus, it is not easy to segment registration plate directly by using information on plate's colors. Additionally, color image processing usually takes longer time than gray-scale image processing. The edge detection is one of the important pre-processing steps in image analysis. Edges characterize boundaries and edge detection is one of the most difficult tasks in image processing hence it is a problem of fundamental importance in image processing. Edges in images are areas with strong intensity contrasts and a jump in intensity from one pixel to the next can create major variation in the picture quality. Edge detection of an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image.

II. MACHINE VISION

The field of machine vision, or computer vision, has been growing at a fast pace. As in most fast-developing fields, not all aspects of machine vision that are of interest to active researchers are useful to the designers and users of a vision system for a specific application. This text is intended to provide a balanced introduction to machine vision. Basic concepts are introduced with only essential mathematical elements. The details to allow implementation and use of vision algorithm in practical application are provided, and engineering aspects of techniques are emphasized. This text intentionally omits theories of machine vision that do not have sufficient practical applications at the time. Automatic registration plate recognition plays an important role in numerous real-life applications, such as unattended parking lots [3], [4], security control of restricted areas [5], traffic law enforcement [6]-[7], congestion pricing [8], and automatic toll collection [9], [9]. In the most of present methods, the conditions of environment and plate, effect on the performance of the method, therefore these methods have limitations. So, reaching the methods that offer the acceptable results is expected.

III. LITERATURE SURVEY

A typical edge in an image might, for instance, be the border between blocks of different colours or different gray levels. Mathematically, the edges are represented by first- and second-order derivatives. The first-order derivative (i.e., gradient) of a 2-D function f(x, y) is defined as vector [11].

$$\nabla f = \begin{bmatrix} G_x \\ G_y \end{bmatrix} = \begin{bmatrix} \frac{\partial y}{\partial x} \\ \frac{\partial y}{\partial x} \end{bmatrix}$$

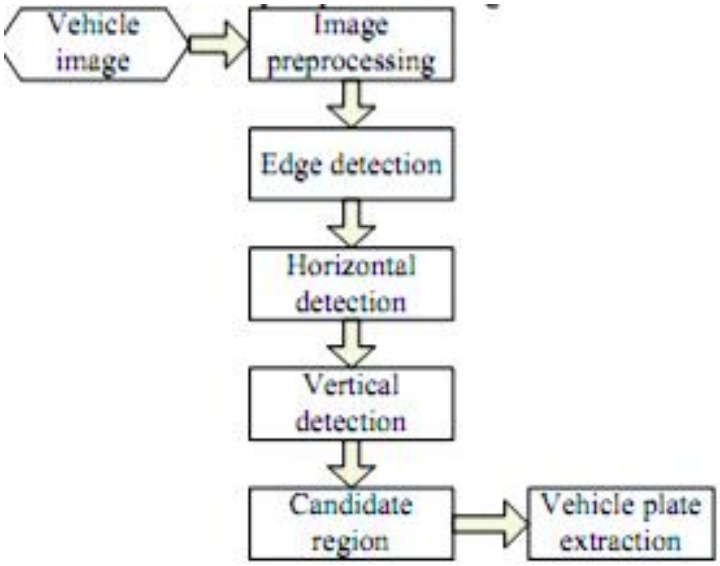
where G_x and G_y are the gradients in the x and y coordinates, respectively. The magnitude of the vector is given by

$$mag(\nabla f) = \sqrt{G_x^2 + G_y^2}$$
$$= \sqrt{(\delta y/\delta x)^2 + (\delta y/\delta x)^2}$$

The angle α at which the maximum rate of change occurs is

$$\alpha(x, y) = \tan^{-1}\frac{Gy}{Gx}$$

Generally, the variance of the gray level is calculated with one of these edge-detection operators or kernel operators. The slopes in the x- and y-directions are combined to give the total value of the edge strength. The edge-detection operator is then calculated by forming a matrix centred on a pixel chosen as
the center of the matrix area. If the value of this matrix area is above a given threshold, then the middle pixel is classified as an edge [11]. The edge-detection methods that have been published may be grouped into two categories according to the computation of image gradients, i.e., the first-order or second-order derivatives. In the first category, edges are detected through computing a measure of edge strength with a first-order derivative expression. Examples of gradient-based edge-detection operators include Roberts, Prewitt, and Sobel operators [12]. The Canny edge-detection algorithm [13], an improved method using the Sobel operator, is known to be a powerful edge-detection method. In the second category, edges are detected by searching a second-order derivative expression over the image, usually the zero crossings of the Laplacian or a nonlinear differential expression.
One of the approaches was by S.Ozbay and E.Ercelebi [14]. They used a black pixel projection based image segmentation scheme to recognize Turkish number plates in the binary domain. They tried to localise the number plate in the image by using a smearing technique. Vertical and horizontal runs of the binarized image were taken. This was followed by segmentation of the plate from the rest of the image based on a particular threshold number of pixels. A similar algorithm was used to segment the component characters from the plate after the image was filtered and dilated. Cross correlation coefficient technique have been used to classify the text. A wavelet transform-based method is used in [15] for the extraction of important contrast features used as guides to search for desired registration plates. The major advantage of wavelet transform, when applied for registration plate location, is the fact that it can locate multiple plates with different orientations in one image. Nevertheless, the method is unreliable when the distance between the vehicle and the acquisition camera is either too far or too close.
In [16], the authors propose a scan line decomposition method of calculating GST in order to achieve considerable reduction of computational load. The result is indeed encouraging as far as the computational time is concerned, but since the scan line-based GST evaluates symmetry between a pair of edge pixels along the scan lines, the execution time
increases linearly with respect to the radius of the searching area. Thus, the algorithm set limits to its effective distance, as a closer view of the plate results to increased processing time. Moreover, this approach is insufficient when rotated or distorted plates appear.



The method proposed in [17] contains four stages as follows: The proposed method which include Image preprocessing as Image gray and stretch, edge detection via eight templates of Prewitt operator, extracting the candidate regions based on horizontal and vertical projection, and locating the plate region exactly with prior knowledge and texture character. After a close observation to the proposed method, we are sure to improve the efficiency as well as results by applying the connectify algorithm technique to identify the longest edge frm an image.

IV. PROPOSED METHOD

In this work, Sobel, which is an edge detection method, is considered. Because of the simplicity and common uses, this method is preferred by the others methods in this work. The Sobel edge detector uses two masks, one vertical and one horizontal. These masks are generally used 3×3 matrices. The masks of the Sobel edge detection are extended to 5 × 5 dimensions [18], for improved results, While in the proposed scheme, 3 x 3 mask window is used.

Vertical Operator

1	2	1
-1	-2	-1

Horizontal Operator

-1		1
-2		2
-1		1

Figure 1: The Sobel operators for edge detection.

The Sobel method for edge detection is based on filtering an image with 2 operators, each of them in charge of estimating the intensity change along one of the axis (horizontal and vertical). The estimation of the change along each axis is later used for generating the so-called gradients. Gradients are vectors representing the strength and direction of the intensity changes at each position of the image.

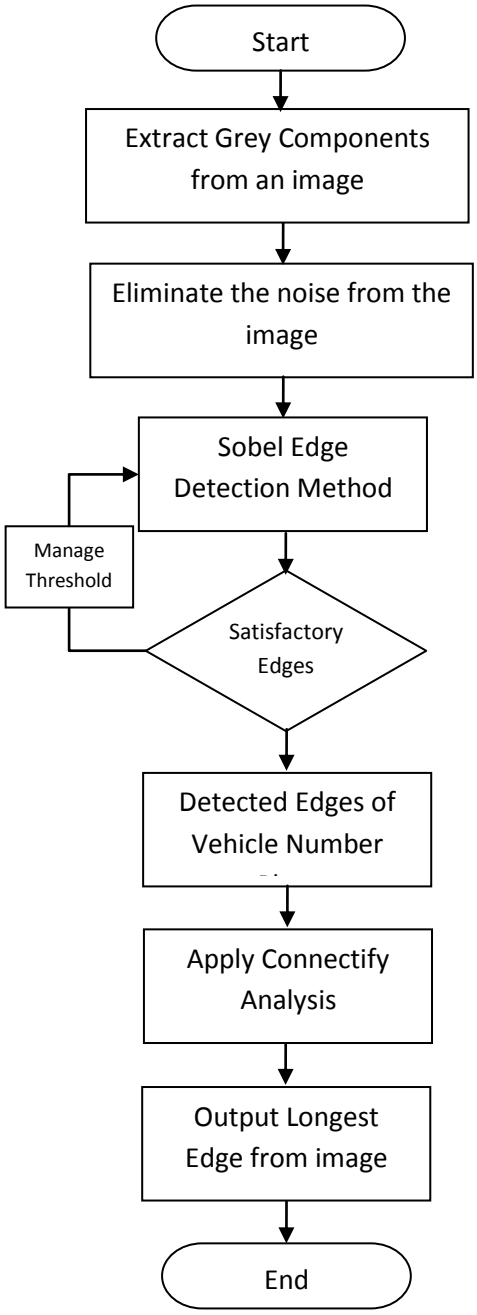


Figure 2: proposed coarse-to-fine strategy of edge detection technique

V. CONCLUSION

The Sobel operator performs a 2-D spatial gradient measurement over the image. Then, the approximate absolute gradient magnitude (edge strength) at each point can be found. It uses a pair of 3 × 3 convolution masks, one estimating the gradient in the x-direction (columns) and another estimating the gradient in the y-direction (rows). The proposed method makes it much easier to distinguish the vehicle registration plate region from the background. The algorithm can also be used to extract the edges of more complex vehicle registration plate images such as turbulent and noisy raw car images. In this paper we have presented a new method of identifying the vehicle registration plate of based on edge detection data. This system will be designed under Matlab software for recognizing a vehicle registration plate. The advantage of this method is that the edges detected are clear and continuous.

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