Vehicle plate recognition

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Abstract

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I. INTRODUCTION

A complete license plate number recognition system needs to complete the process from image acquisition to character recognition output. The process is quite complicated. It can basically be divided into a hardware part and a software part. The hardware part includes system triggering, image acquisition, and the software part includes image preprocessing, license plate positioning, and characters. The four parts of segmentation and character recognition. This paper presents a location algorithm based on color features. The algorithm does not need to perform edge detection on the entire image, but directly finds the connected areas where the color, shape and texture of the image match the license plate features. Through the analysis of a large number of license plate images, it can be found that for pixels with a certain target color, they can be filtered directly by setting a range for the three components of H, s, and v, without the need for more complex color distance calculations. Can save a lot of time in color segmentation. This filtering is particularly effective for blue and yellow license plates, but it is not ideal for black and white filtering. This is because for pure colors of black and white, their hue and saturation are meaningless, so compared with other colors, two filtering indicators are missing.

Luminance value quantization

There are four basic method to do quantization, the following content will briefly introduce the methods:

Component method:

The brightness of the three components in the color image is used as the gray value of the three gray images, and a gray image can be selected according to application needs.

Maximum Method:

Use the maximum value of the three-component brightness in the color image as the gray value of the gray image.

Mean Method:

The three-component color image obtained by averaging the luminance grayscale gradation value

Weighted average method:

According to importance and other indicators, the three components are weighted and averaged with different weights. Common algorithms:

f(i,j)=0.30R(i,j)+0.59G(i,j)+0.11B(i,j)

Advantages of greyscale:

1. RGB values are the same.

2 The image data is the palette index value, which is the actual RGB value (the brightness value).

3 Since it is a 256-color palette, one byte in the image data represents one pixel and it will be very integrate.

Image binarization

The binarization of the image is conducive to the further processing of the image, making the image simpler, and reducing the amount of data, which can highlight the contour of the target of interest. In matlab, binarized images are often represented by arrays of 0 and 1. There are basically 2 common algorithms for binarization.

• Global binarization method

Calculate a single threshold for each picture. Pixels whose gray level is greater than the threshold are marked as background color, otherwise they are foreground.

• Local adaptive binarization

The threshold value of each pixel is calculated based on the information of the neighborhood of the pixel. Some of these methods also calculate a threshold surface in the entire image. If the gray level of a pixel (x, y) in the image is higher than the calculated value of the threshold surface at the point (x, y), then the pixel (x, y) is marked as the background, otherwise it is the foreground character.

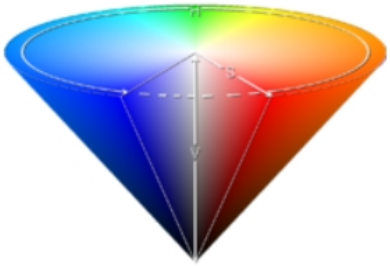
II. BACKGROUND AND MODEL

1.A Location method based on color characteristics of license plate

This paper presents a location algorithm based on color features. The algorithm does not need to perform edge detection on the entire image, but directly finds the connected areas where the color, shape and texture of the image match the license plate features. Through the analysis of a large number of license plate images, it can be found that for pixels with a certain target color, they can be filtered directly by setting a range for the three components of H, s, and v, without the need for more complex color distance calculations. Can save a lot of time in color segmentation. This filtering is particularly effective for blue and yellow license plates, but it is not ideal for black and white

filtering. This is because for pure colors of black and white, their hue and saturation are meaningless, so compared with other colors, two filtering indicators are missing.

The experimental data shows that the HSV value of the car license plate can be determined by the following table.



	黑	灰	白	红		橙	黄	绿	青	蓝	紫
hmin	0	0	0	0	156	11	26	35	78	100	125
hmax	180	180	180	10	180	25	34 ;	77	99	124	155
smin	0	0	0	43		43	43	43	43	43	43
smax	255	43	30	255		255	255	255	255	255	255
vmin	0	46	221	46		46	46	46	46	46	46
vmax	46	220	255	255		255	255	255	255	255	255

Due to the special principle of the algorithm, it was decided to mainly recognize the white license plate on the blue background of the family small car. According to the RGB ratio of the color image, a candidate area that is similar to blue is located. However, since the Euclidean distance between two points in the RGB three primary color space is not linearly proportional to the color distance, it cannot be well controlled when setting the positioning range of the blue area. Therefore, the positioning error caused is the most important. In this way, the recognition rate will decrease when there are more blue backgrounds in the picture, and the license plate area cannot be extracted effectively. In this paper, an adaptive adjustment scheme is proposed. Recognize and adjust the segmented area. According to the aspect ratio, the candidate area is positioned multiple times in blue-white comparison. Finally find the license plate area.

```
p=[0.56 0.71 0.4 1 0.3 1 0];
for i = 1 : y
    for j = 1 : x
        hij = I(i, j, 1); %hue
        sij = I(i, j, 2); %Saturation
        vij = I(i, j, 3); %value
        %determination of blue pixels
        %background colour of chinese plate is blue
        if (hij>=p(1) && hij<=p(2)) &&( sij >=p(3)&& sij<=p(4))&&...
                (vij>=p(5)&&vij<=p(6))
            %use the number of blue pixels on every row
            %to determine upper and lower bound of plate
            Blue_y(i, 1) = Blue_y(i, 1) + 1;
        end
    end
end
```

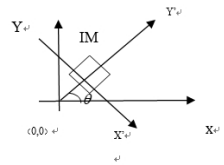
2. License plate tilt correction

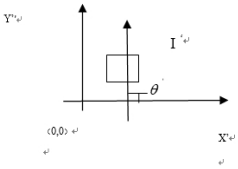
In the license plate recognition system, the premise that the license plate characters can be segmented correctly is that the license plate image can be horizontal, so that the horizontal projection and vertical projection can be performed normally. If the license plate tilt is not corrected, the horizontal projection and vertical projection, and even the rivets cannot be processed normally. License plate correction is an important process of license plate positioning and character segmentation. The license plate image obtained after the license plate location inevitably has a certain degree of tilt. This tilt will not only bring difficulties to the next character segmentation, but will also have a direct impact on the accuracy of the license plate recognition. Therefore, when obtaining the license plate in the vehicle information, the first step should be to check the tilt angle and make tilt correction. This section mainly introduces the algorithm MATLAB for license plate image correction.

There are several license plate correction algorithms, mainly Hough transform method and Radon transform method. The following mainly introduces the Radon transformation method

Image projection means that the image is linearly integrated (or understood as cumulative sum) in a certain direction. If the image is regarded as a two-dimensional function f(x, y), its projection is the linear integral in a specific direction, for example, the linear integral of f(x, y) in the vertical direction is its projection on the x axis; The line integral of f(x, y) in the horizontal direction is its projection on the y axis. Through these projections, the outstanding characteristics of the image in the specified direction can be obtained, which may be used in image pattern recognition and other processing.

Radon transformation (Radon transformation) is to transform the digital image matrix on the ray direction of a specified angle. This means that Radon transformation can be done along any angle theta.



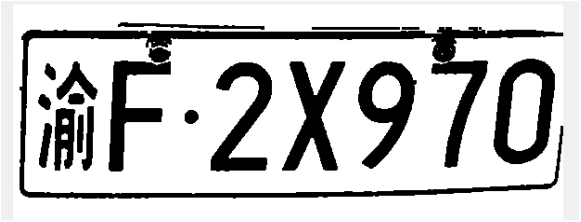


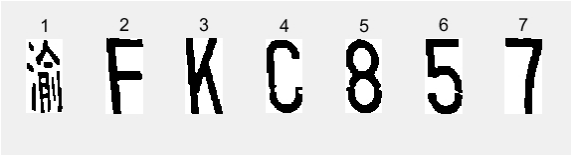
```
[~, MaxY] = max(Blue_y); %represents the row that contains the most blues pixels
Th = p(7);  % p(7) = 0
PY1 = MaxY;
while ((Blue_y(PY1,1)>Th) && (PY1>0))
    PY1 = PY1 - 1;  % fine the upper bound of plate
end
PY2 = MaxY;
while ((Blue_y(PY2,1)>Th) && (PY2<y))
    PY2 = PY2 + 1;  % fine the lower bound of plate
end
```

```
[~, MaxX] = max(Blue_x);
Th = p(7);
PX1 = MaxX;
while ((Blue_x(1,PX1)>Th) && (PX1>0))  % find the leftmost bound
    PX1 = PX1 - 1;
end
PX2 = MaxX;
while ((Blue_x(1,PX2)>Th) && (PX2<x1))  % find the rightmost bound
    PX2 = PX2 + 1;
end
```

3. Character segmentation

In the process of automatic license plate recognition, character segmentation has the effect of connecting the past and the future. It performs character segmentation based on the previous license plate positioning, and then uses the segmentation result to perform character recognition.





Character segmentation generally uses vertical projection. Because the projection of the characters in the vertical direction must be near the local minimum at the gap between the characters or the characters, and this position should meet the character writing format, characters, size restrictions and some other conditions of the license plate. The vertical projection method has a good effect on character segmentation in car images in complex environments.

The specific algorithm is as follows:

1. Determine the approximate height range of the characters in the image: first scan the image line by line from bottom to top until the first melanin pixel is encountered, mark the line number, and then scan the image line by line from top to bottom until When you encounter the first melanin pixel, write down the number. These two line numbers indicate the approximate height range of the characters.

2. Determine the left start and right end position of each character: scan column by column from left to right within the height range obtained in the first step. When the first black pixel is encountered, it is regarded as the starting position of character segmentation , And then continue scanning until there is no black pixel in a column, which is considered to be the right end position of this character, and it is ready to start the next character segmentation. Continue scanning as described above until you reach the right end of the image. In this way, a more accurate fast reading range of each character is obtained.

3. Within the known relatively accurate width range of each character, follow the method of the first step to scan line by line from bottom to top and top to bottom to obtain the precise height range of each character.

When dividing the left and right boundaries of the license plate characters, through the vertical scanning process, because the numbers and letters are connected, it is easier to divide the numbers and letters. Through the vertical scanning process, the number of black pixels is counted. Since there are no black pixels between two characters, it can be used as the boundary of character segmentation.

4. Character recognition

The gray value of the pixel in the character image of the license plate to be recognized, where the value is 0 or 1, is the gray value of the pixel in the template character image, the value here is 0 or 1; M and N are the template character points The number of pixels contained in the horizontal and vertical rows of the array.

The matching steps are:

(1) Take out the template characters in sequence, slide the template characters in the four directions of up, down, left, and right in the range of five pixels around, calculate the similarity S value each time, and take the maximum value of S as The similarity function between characters and template characters.

(2) In turn, find the template character corresponding to the maximum similarity from the similarity between the character to be recognized and the template character, and determine whether it is greater than the threshold T of the character. If S is greater than T, then the matching result of the character to be recognized is The template character, on the contrary, if S is less than T, it means that it does not match, and it needs to be checked again.

III. CONCLUSION

In this paper, we propose a method of plate recognition, a program combine several methods. i.e. extract, normalize, slope correction, and character recognition. Thereby, the plate can be transformed into text, which can be applied on business, research, and other fields.

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