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An Enhanced Bernsen Algorithm Approaches for Vehicle Logo Detection

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Abstract

Image segmentation successfully achieved by employing image binarization technique. In this paper, a new method is proposed for detecting the vehicle logo in an image. The proposed method is applied to determine a local threshold for each pixel. In this method, we use the different value of lambda. In our proposed method, we use the double mean filter to remove noise. Experimental resultsproofthatthe proposed methodisfast and successfully detect all edges,with minornoise.In addition, it has the feature of smaller entropycompared toothermethods.

Keywords: *Image binarization, Bernsen algorithm, vehicle logo*

1. Introduction

Image binarization is a crucial technique for image segmentation. The aim image binarization is to partition an image's pixels into foreground and background group [1]. It is core technique in various applications, the edge extraction, and object extraction, processing and image segmentation shape, especially [2]. The variance between-group should be as maximum as possible and the within-group variance should be as minimum as possible [1]. Appropriate threshold is picked out in the binary process of the essence elements. Threshold has a direct impact on the binarization results features. The high threshold leads to incomplete extraction of the target region; otherwise, it yields to raise noise. The problem is still to find out the suitable algorithm used for all images [3]. The difficulty is the selection optimum binarization algorithm where the different binarization algorithm yields different performance on different data sets. This trouble is apparent when dealing with old images where variation in contrast and illumination. The algorithms split up into two groups; Global Binarization, and Local Binarization. The global binarization methods apply single threshold value for entire image, and the local binarization method where the threshold value computed locally pixel by pixel or region by region [4]. For the above types, the basic binary method is improved, or a combined to develop the binarization output, but edges are not accurate enough. This paper presents a method to improve the local threshold from new binarization method based on Bernsen algorithm. The aim of the proposed method is to detect the vehicle logo from the vehicle front picture and detect details and edges of any image. The proposed method returns more accurate result compared to global binarization methods such as Otsu method [5] , Kittler method [6]. In addition, it also shows a better result compared to the local binarization such as Niblack method [7] and Bernsen method [8]. The proposed method is providing a method to detect vehicle information, License plate (LP) recognition, and detection of vehicle logo [9]. Because of the different vehicle models and designs the logo position and location [10], and shape is diverse from vehicle to another as shown in Figure 1;

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If the vehicle logo successfully localized, the precision of vehicle logo detection is assured [11]. The rest of this paper is organized as follows. Section 2 cover and outline the related algorithms to the proposed method and explain and outline the proposed method. Section 3 Mathematical Morphology. Section 4 Vehicle Logo Information. Section 5 Vehicle logo detection. Section 6 shows experimental results. Finally, Section 7 presents this work conclusion.

Figure1. Show Vehicle Logos in Different Locations: Middle of the Radiator Grille, on the Hood, and Complex Grilles in the Radiator Grille

2. Binarization Methods

2.1 Bernsen Method

For uneven illumination,Bernsen algorithm is proposedespeciallyfor shadow removal. Let $f(x,y)$ refer to a gray value of points (x,y). Consider block whose centre is a point (x,y) and the size is $(2\omega+1)\times(2\omega+1)$. The threshold $T(x,y)$ of $f(x,y)$ is calculated by:

$$T(x,y)=0.5\times\left(\max_{\substack{-\omega\le m\le\omega\\-\omega\le n\le\omega}} f(x+m,y+n)+\min_{\substack{-\omega\le m\le\omega\\-\omega\le n\le\omega}} f(x+m,y+n)\right) \quad (1)$$

2.2. The Proposed Method

Most of the current methods are suffering from slowness of image extraction. In this, paper aims to propose a new method based on Bernsen algorithm to detect a vehicle logo, details,

and all edge from any image. The proposed method is used for local binarization; a window of $N \times N$ block slide over the entire image and threshold value is computed for each local area under the window for binarization.

Let $f(x, y)$ denote a gray value of the point (x, y). Consider a block whose centre is a point (x, y) and size is $(2w + 1) \times (2w + 1)$.The threshold $T(x, y)$ of $f(x, y)$ is computed by.

$$T^{*} = \lambda_1 \times T_1 + \lambda_2 \times T_2 \quad (2)$$

$$T^{*}(x, y) = 0.7 \times \left(\max_{-w \le k \le w} f(x + k, y + k) \right) + 0.3 \left(\min_{-w \le k \le w} f(x + k, y + k) \right) \quad (3)$$

The condition of this equation $\lambda_1 + \lambda_2 = 1$ and $\lambda_1 > \lambda_2 > 0$.The part T_1, T_2 is difference value.

1. Compute the threshold $T_1(x, y)$ of $f(x, y)$.

$$T_1(x, y) = 0.7 \times \left(\max_{-w \le k \le w} f(x + k, y + k) \right) + 0.3 \left(\min_{-w \le k \le w} f(x + k, y + k) \right) \quad (4)$$

2. According to simple image binarization were preformed on the image, pixels with values greater than the threshold t were classified as white, and all other pixels as black.

$$T(i, j) = \begin{cases} 255 & \text{if } f(x,y) > T^{*} \\ 0 & \text{if } f(x,y) \le T^{*} \end{cases} \quad (5)$$

3. To remove noise a double mean Filter were applied.

4. Compute the threshold $T_2(x,y)$ of $\hat{f}(x,y)$ as:

$$T_2(x, y) = 0.7 \times \left(\max_{-w \le k \le w} \hat{f}(x + k, y + k) \right) + 0.3 \left(\min_{-w \le k \le w} \hat{f}(x + k, y + k) \right) \quad (6)$$

5. The morphological operation dilation is used on the image to fill the holes and connect the broken lines.

3. Mathematical Morphology

In the image-processing morphological erosion and dilation are an important foundation [12]. Dilation is a process of extemporizing applied image by filling holes in an image, sharpen the edges of objects in an image, and join the broken lines and increment the brightness of an image. Using dilation, the noise within an image can also be moved out. By sharpening the edges, the difference of gray value between neighboring pixels at the edge of an object can be enhanced, which is led to improve edge detection.

In Number vehicle logo Detection, the image of a car plate may not always contain the same brightness and shades. Consequently, the given image has to be converted from RGB to be gray from [13].

4. Vehicle Logo Information

In this paper, the image information H (Image) is broken into the vehicle logo information (foreground); while the rest of image is information H (Background), which is presented herein after:

$$H(Image) = H(foreground) + H(Background) \quad (7)$$

For find the distinct features; we separate vehicle images into three groups; the whole image, the vehicle logo and the zone without the vehicle logo, respectively; then we calculate the histogram of gradient direction.

It can be observed from the results in Figure 2 that the whole image basically consists of the horizontal and vertical direction information. The region without the vehicle logo primarily comprises of the horizontal and vertical direction information, while no specific direction information within the vehicle logo zone [11].

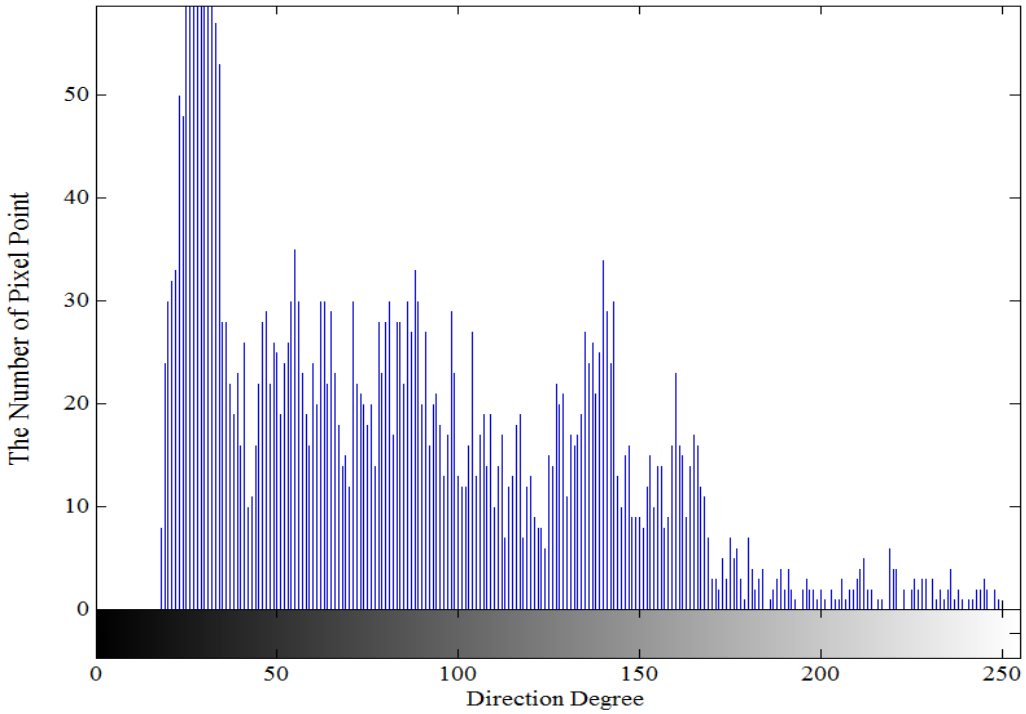

Figure 2. The Histogram of the Vehicle Logo Region

The logo image and its sensitivity to light gray level of diversity are reflected by direction degree of a number of pixel points. Figure 2 is selected for image of the vehicle logo region, as shown in the figure there is the number of peaks and valley.

5. Vehicle Logo Detection

The analysis of binary image leads to figure out vehicle logo area is detected in horizontal and vertical filtered binary images, although this region may contain many other devices. If one binary image had minor foreground information, the detection rate can be developed by applying information entropy theory to choose the image. For the complex and disorder of image, the value of entropy is decreased accordingly [11]. We denote the entropy of candidate image E_{BJ} with possible pixel values $\{x_1, x_2, ..., x_n\}$ and probability mass function $p(x)$ as:

$$E_{BJ} = -\sum_{x=1}^{255} p(x) \log(x) \quad (8)$$

When E_{BJ} is smaller image details is clearer, and where E_{BJ} is greater, the detail is unclear[14].

6. Experiment Results and Analysis:

In this section, we show the experimental results of the proposed method. The proposed algorithm was implemented in MATLAB (R2012 b), and tested in windows 8 with Intel (R) core (TM) i7-3632QM CPU @ 2.20 GHz 2.20 GHz with a memory of 4GB. Test image is extracted from the traffic stream and traffic surveillance equipment in images taken logo image. The experimental testing Tools MATLAB. Table 1 shows some experimental results:

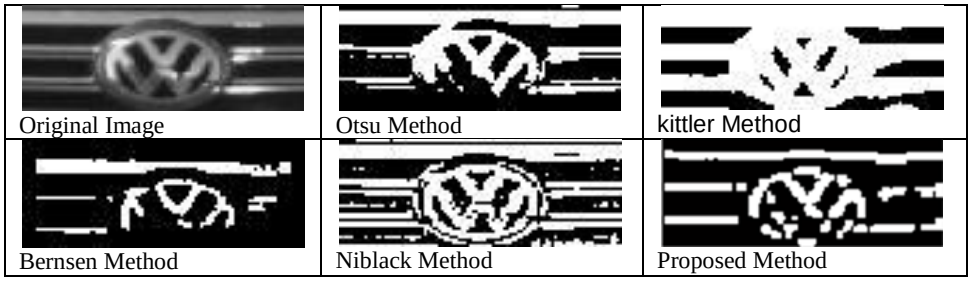

Figure 3. Experimental Results For Local and Global Binarization Methods

In order to make comparisons, we implemented five other binarization methods, two of them are global threshold methods are Otsu, and Kittler method; the other three are locally adaptive methods proposed by Bernsen, Niblack, and the proposed method. The extracted logo shown in Figure 3 by the proposed method is clearer and well separated from the surrounding objects when compared with the other methods. Moreover, the resulted image has less noise than the other approaches. The logo in Otsu method is not complete and has noise while the resulted logo of the Kittler method is not well separated and has thicker lines. The Bernsen Method logo is not clear and also not complete. On the other hand, the Niblack method logo is clear and complete but has the highest noise in contrast with the other methods.

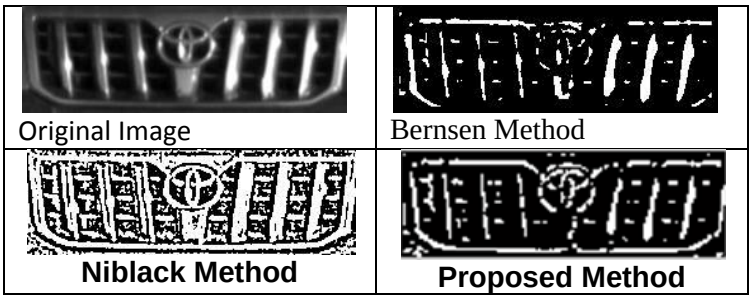

Figure 4. Experimental Results (Local Binarization)

The Local threshold method is more sensitive to changes in details. For more verification, we implement the proposed method for another logo, which had different features and details. Bernsen and Niblack methods are compared to the proposed method.

The result of the proposed method and compared methods shown in Figure 4 is more complete and well separated from the surrounding objects when compared with the other methods. Moreover, the result image has less noise than the other methods.

Table 1. Three Method Performance Comparisons

Method	Index	Experiment Image	
		Figure (5)	Figure (6)
Bernsen	Processing time (t)	0.192240	0.233502
	Entropy(E)	0.6622	0.5442
Niblack	**Processing time (t)**	4.034822	4.054899
	Entropy(E)	0.6565	0.6917
Proposed	**Processing time (t)**	0.192149	0.233415
	Entropy(E)	0.5637	0.3771

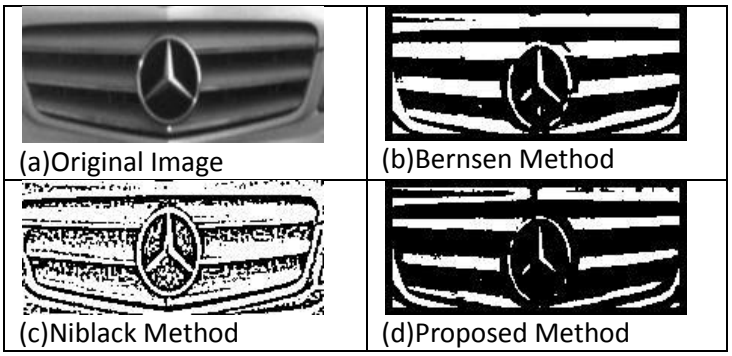

Figure 5. The Binary Image of the Vehicle Logo Image

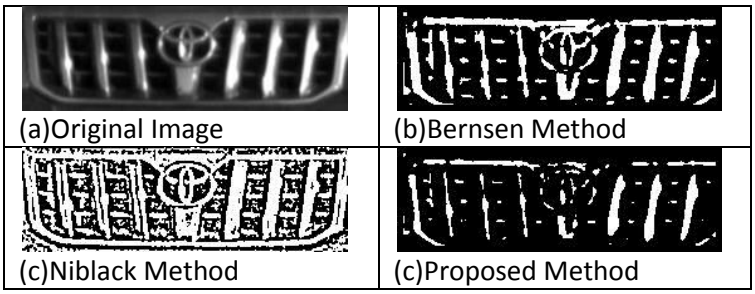

Figure 6. The Binary Image of the Vehicle Logo Image

For Figure 3(a) and Figure 4(a), the three algorithms are run more times separately. The processing times and the entropies are shown in Table 1. And the binary images are shown in Figure 3(d) and Figure 4(d). According to values in Table 1, it is shown that the proposed method seems to be best.

7. Conclusion

In this paper, a new method is proposed for the detecting of vehicle logo in an image. The advantage of the proposed method is its capability for detecting clear edges in any image. The experimental results yield that the proposed method is fast, accurate with no noise; moreover, it is practicable for image binarization, and is more effective than another Bernsen and Niblack entropy methods.

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