Character Recognition of Instrument Board in Sequent Color Images

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ABSTRACT

In this paper, a new method of recognizing characters on instrument board of plane cockpit in sequent color images is proposed. Our proposed method is executed by three procedures. In the first step, an adaptive linear stretching is developed for improving the brightness of instrument board from complex background. With the sequential ability of these color images, the statistical property of histogram of processed images will use to guide automatically the linear stretching of processing color images. In the second step, the pyramid-link thresholding improved is to determine the optimal threshold for extracting instrument board for real time processing of sequent images. In the last step, characters can be described clearly by thinning and recognized by standard mask marching. Our method has been demonstrated using practice sequent color images. Experimental results have shown that our method is adaptive and significant.

Keywords: character recognition, thresholding, image enhancement, sequential image processing.

1. INTRODUCTION

Character recognition is very important in computer vision. Although recognition is easy to be done when characters have great difference with background in general static images, it is very difficult in many cases when the gray levels of the characters will be changed with the background. For a pilot in the back cockpit, the display is the main information source. The original sequent images can be classified as infrared images, color images and weak light images. The quality of sequent images obtained from the plane cockpit is not better due to the great influence of outside sunshine in the sky. Therefore, the object extracted, instrument board in these original images, is often confused with complex background. The gray level of the character may have a wide dynamic range because of the great change of the outside sunshine. It makes character recognition of instrument board difficult.

A lot of techniques have been improved for character recognition. However, many algorithms proposed are only effective in the simple or special background. In this work, we proposed an adaptive approach for recognizing characters from real time sequent color images. We attempt to enhance the features of the objects by using the linear stretching. With the sequentiality of these color images, the statistical property of histogram will use to guide automatically the stretching. Since Ostu' method has good adaptation for segmentation, the pyramid-link thresholding based on Ostu' method is used for extract instrument broad. The characters can be recognized by using standard mark marching. Our proposed method improves the adaptive performance of recognition for color sequent images.

2. THE PROPOSED CHARACTER RECOGNITION

Linear gray stretching is to stretch the histogram according to a linear transforming function, which can be expressed as $D_B = f(D_A) = f_a \times D_A + f_b$, where f_a is the slope, D_A is the gray level of the input image and f_b is the intercept. In order to get an adaptive transforming function, we should obtain the parameter f_a and f_b automatically. By analyzing the statistics of the histogram, two important points *a* and *b* is induced. The proportion of those pixels whose gray levels are lower than *a* is *p%*. In the mean time, the proportion of those higher than *b* is also *p%* . Therefore, the transform function is

$$\boldsymbol{D_B = \frac{255}{b-a} \bullet D_A + \frac{255 \times a}{b-a}},$$

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This adaptive method is better than the histogram equalization in that it combines those pixels with too high or too low gray level. And it simplifies the background and makes the recognition easier.

Automated thresholding is one of the expected intelligent features of the system. Many techniques for automatic thresholding are reported and available in the literature [1-2]. Among these techniques, Ostu' is usually used to select a threshold for two-peak image. Because of the complexity of processing image, two thresholds are needed to distinguish the instrument board. If Ostu' method is utilized directly to get the two thresholds, the object cannot be extracted correctly and the computation load is large. So we choose a pyramid-like algorithm to improve Ostu' method for obtaining the suitable thresholds. First, we get a threshold by using the usual Ostu' method in the whole gray level range. Since the characters are often bright in high grey level, another threshold is decided by Ostu' method in the range of the first threshold and the highest grey level. By this method, the computation speed is increased a lot.

The instrument board is composed of the standard digits and signs, which are in fixed positions. So after thinning, in every given position we use the standard digits and signs to match the processed image.

3. EXPERIMENTAL RESULTS

Our method has been implemented by the development of the real-time image processing software based on Visual C++. Our proposed method have been sucessful for real time processing of sequent color images. To verify the effectiveness of our proposed method, two real color images are demosterated here. The results are shown in Fig1-Fig2. Experiments are conducted using C++ programming on a Pentium IV 800 with 512MB memory. The results have shown that characters can be clearly recognized from segmented instrument broad.

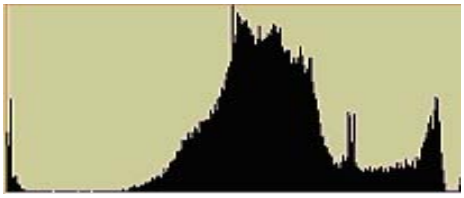

Fig1. (a) Histogram of the original image

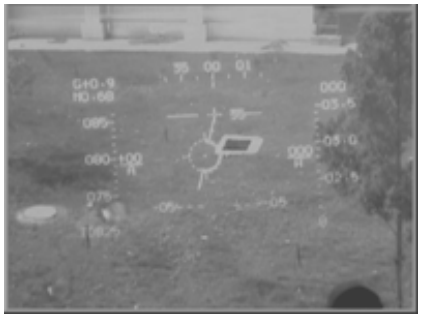

Fig 1. (b) The original image

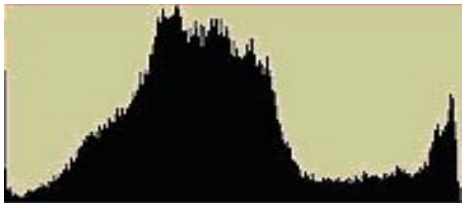

Fig1. (c) Histogram of stretching image

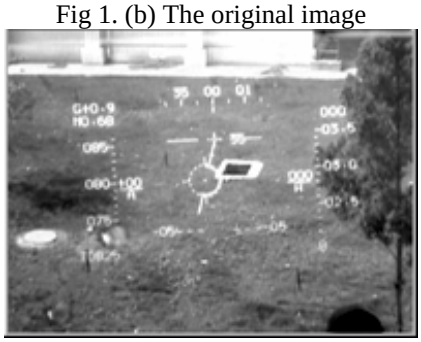

Fig 1. (d) The stretching image

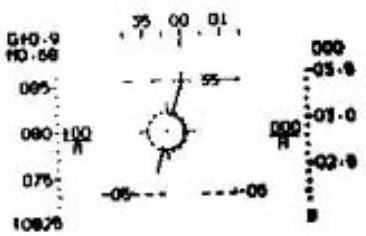

Fig1. (e) Extraction of instrument broad

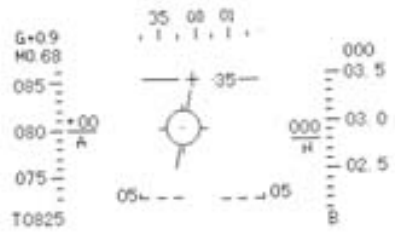

Fig 1. (f) Character recognition

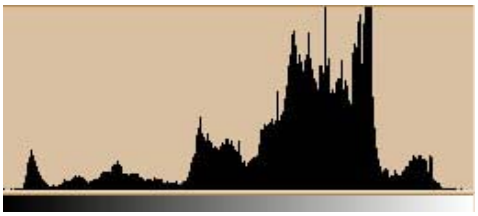

Fig2. (a) Histogram of the original image

Fig 2. (b) The original image

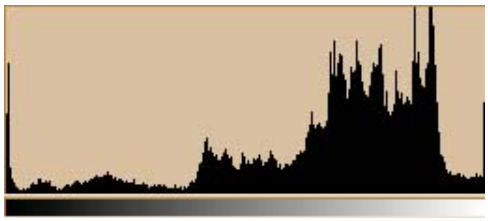

Fig2. (c) Histogram of stretching image

Fig 2. (d) The stretching image

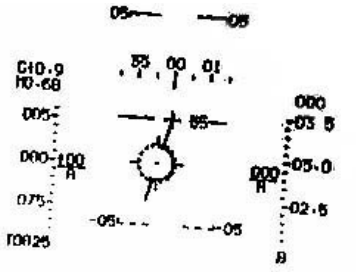

Fig2. (e) Extraction of instrument broad

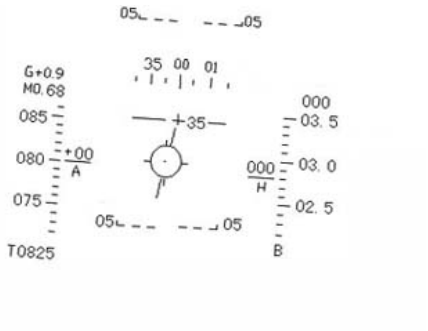

Fig 2. (f) Character recognition

4. CONCLUSION

Although character recognition is easy to be done when characters have great difference with background in general static images, it is very difficult in many cases when the gray levels of the characters will be changed with the background especially sequential images. In this paper, we proposed the new method for recognizing characters on instrument board of plane cockpit. The linear stretching is firstly applied for improving the brightness of instrument board from complex background. With the sequential ability of these color images, the statistical property of histogram of processed images is used for guiding automatically the linear stretching. The pyramid-link thresholding is then to determine the optimal threshold for extracting instrument board. Characters recognition can be finally done by using standard mask marching. Our method has been demonstrated using practice sequential color images. Experimental results have shown that our method is adaptive and significant.

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