Proposal of Image Detection Algorithm to Implement Hand Gestures

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Abstract

This paper proposes an image detection algorithm to implement gesture. By using a camera sensor, the performance of the extracted image algorithm based on the gesture pattern was verified through experiments. In addition, through the experiments, we confirmed the proposed method's possibility of the implementation. For efficient image detection, we applied a segmentation technique based on image transition which divides into small units. To improve gesture recognition, the proposed method not only has high recognition rate and low false acceptance rate in real gesture environment, but also designed an algorithm that efficiently finds optimal thresholds that can be applied.

Key words: gesture recognition, image detection, segmentation, optimal thresholds, histogram equalization

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I. Introduction

The histogram equalization used in the gesture detection method is widely used in various applications due to its simple and effective function. Histogram equalization is a technique that adjusts the brightness of an image which has biased value to the one side by distributing the histogram of the gray value evenly to a dark or bright. [1]

However, brightness distortion of the output image occurs due to excessive brightness change of the image after histogram

equalization application. Therefore, in order to prevent image distortion, it is necessary to study an algorithm that suppresses excessive brightness change of image. Therefore, in this paper, we look into the improving methods contrast to the basic light and darkness and propose the way of enhancing contrast with light and darkness by the effective application to the dark video clip which has dynamic area is far narrow.

The increase of contrast with light and darkness is possible by widening the dynamic range defined by the brightness of the darkest part and brightest part of the image pixel. In this way, the improved image provides a clear image to the eye or facilitates image processing for feature extraction in a computer image system with an easy way. [2], [3], [4], [5]

The proposed method limits the histogram with high frequency of image to the threshold value and by using the dynamic range expansion factor. It is possible to suppress the amplification of the noise component around the high contrast with light and darkness caused by the increase of the excessive contrast, which is a typical disadvantage of the existing techniques, and to expand the dynamic area while naturally maintaining the natural contrast of light and darkness of the original image. [6], [7], [8]

II. Proposed algorithms

2.1 Histogram equalization

Fig. 1. is the original image of the hand gesture in the experimental range. Fig. 2. shows a binarized image for histogram equalization. Histogram equalization is an algorithm that distributes the distribution of the histogram's light and darkness widely. If the skewed one-sided histogram in the image is mainly used and the range from the darkest region to the brightest region is widened, the contrast of the image increases and the image can be seen in more detail.

$$H(X_k) = n_k \quad (1)$$

In the Equation (1), X_k is the k-th intensity and n_k represents the number of pixels with the same intensity as X_k. As shown in Fig. 3, the histogram can be normalized by dividing with the total number of pixels in the image. [9], [10]

Fig. 1. Original image

Fig. 2. Binarization image

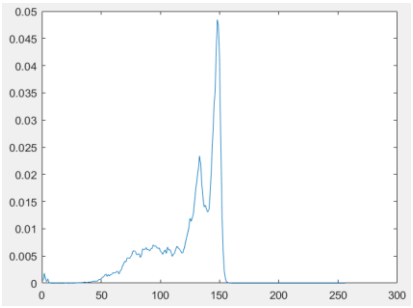

Fig. 3. Distribution chart of original image

2.2 Proposed algorithm

Existing algorithms have problems such as color distortion and excessive brightness

change due to excessive contrast enhancement. Therefore, we propose a new algorithm to prevent excessive brightness change of existing algorithm. The proposed algorithm obtains a histogram of a dark video and substitutes a threshold value for a region having a high frequency distribution in the histogram, and giving to a corresponding region having a high frequency distribution to a threshold value. In this case, the influence of many pixels having almost the same brightness is limited, so that the histogram generated again from the dynamic range of the original image will have a small range. If the histogram distribution is too narrow, existing algorithms lose their naturalness because they improve through the greatest dynamic range expansion. However, the proposed algorithm suppresses this and preserves the naturalness of the original image.

The proposed contrast algorithm is shown in Fig. 4 as a simple flowchart.

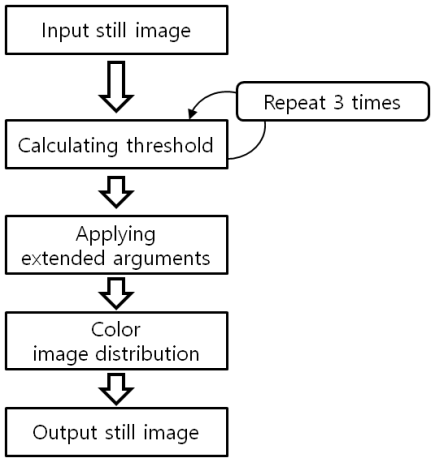

Fig. 4. Proposed algorithm's total flowchart

The threshold value of the histogram is defined as the frequency corresponding to the average value of light and darkness in the image. The threshold value is the frequency obtained by multiplying each band by the corresponding frequency and dividing the sum of the values by the total number of pixels.

The above process can be repeated twice to obtain the final threshold value, whereby a threshold value that can be variably applied according to the bandwidth of the input image can be obtained. The extension factor of the histogram is defined in proportion to the average value of the contrast in the image. The expansion factor is the value obtained by dividing the average contrast value by the total contrast value and multiplying it by the maximum frequency. This value can be used to suppress the expansion of the dynamic range. This can be expressed as Equation (2).

$$S_k = p_{max}(X_i) \times \left(\frac{M_k}{L-1}\right) \qquad (2)$$

In this equation, S_k represents the expansion factor, and $p_{max}(X_i)$ represents the maximum frequency that the intensity of the input image can have. M_k defines the average value of contrast. To have a uniform distribution, the histogram was set in the range [0, -1].

Ⅲ. Image processing experiments

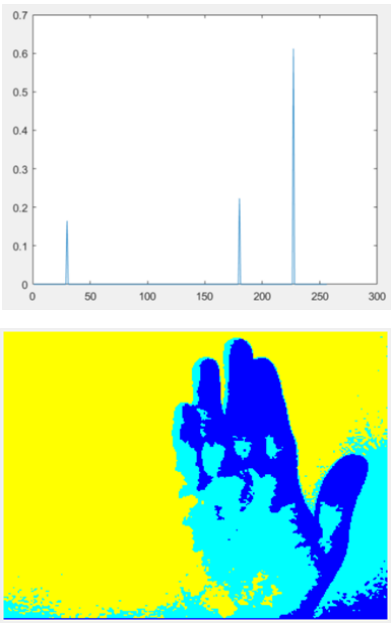

Fig. 5. Proposed image color segmentation and threshold calculation

Fig. 5 is the image experimented in the general environment. However, since the color image values of the pixels are different from each other, it is confirmed that the threshold values of the original image are the same, and the output's color intensity state can be obtained according to the proposed division method.

Ⅳ. Conclusion

In this paper, we propose a real - time physical motion recognition technique using a camera sensor for gesture recognition. For accurate recognition, we propose a method to improve contrast by using threshold value and determining method of dynamic region expansion factor. Experimental results show that the dynamic range expansion is limited to reflect the characteristics of the image according to the average value of the contrast. Unlike the existing algorithms which extend the dynamic range as a whole, the proposed algorithm is designed to maximize the inter-class scattering area for image segmentation; thereby we confirmed that suppressing image distortion and expanding the use area to improve the contrast ratio naturally

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