Research on Face Detection under Different Lighting

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Abstract

Face detection is a biometric identification technology based on human facial feature information. This study uses the logitech C310 camera to collect images with faces and automatically detect faces in the images, and then carry out a series of technical processing on the detected faces. The traditional face detection technology is mainly based on visible images, which is also familiar with the detection method. But this kind of method has insurmountable defect, especially when the light environment changes, the detection effect will fall sharply, cannot meet the need of the actual system. The purpose of this study is to solve the classic problem of face detection under different lights, and to develop an intelligent and efficient human face detection method on Visual Studio 2015 platform software and OpenCV technology.

Key words: Face detection, Webcam, Visual studio 2015 and Opencv technology .

I. Introduction

Face detection is one of the steps in all face analysis algorithms, including face alignment, face modeling, face recognition, face detection, face verification, face recognition and facial expression tracking. [1]. Face detection has always been a valuable research field, and the benefits of face detection are numerous. The application fields of face detection include law enforcement identification, security bank certification, computer network and financial transaction, airport automatic screening. [2].

Face detection is a very valuable research field, and the detection technology has been studied for more than 30 years, but there are still some deficiencies in some aspects. The detection under dim light is one of the classical problems, and the difference between the same individual and the same light is greater than that of different individuals under the same light. Therefore, it is of great significance to improve the performance of face detection algorithm if the appropriate method is explored to preprocess the image of the face with strong illumination or too weak.

OpenCV provides a powerful infrastructure for computer vision applications [3], this study used the existing technologies, such as Principal Component Analysis, Linear Discriminant Analysis, Local Binary Pattern of three kinds of technology, by methods of pretreatment, feature detection, illumination solution of face in a simple environment problems were detected in different light.

II. Methods

This study used Haar classifier, Haar classifier = haar-like feature + integral graph +AdaBoost+ cascade. The AdaBoost algorithm is usually aimed at grayscale images [4].

Before the face detection, we pretreated the image, and the specific operation process was shown in Fig. 1.

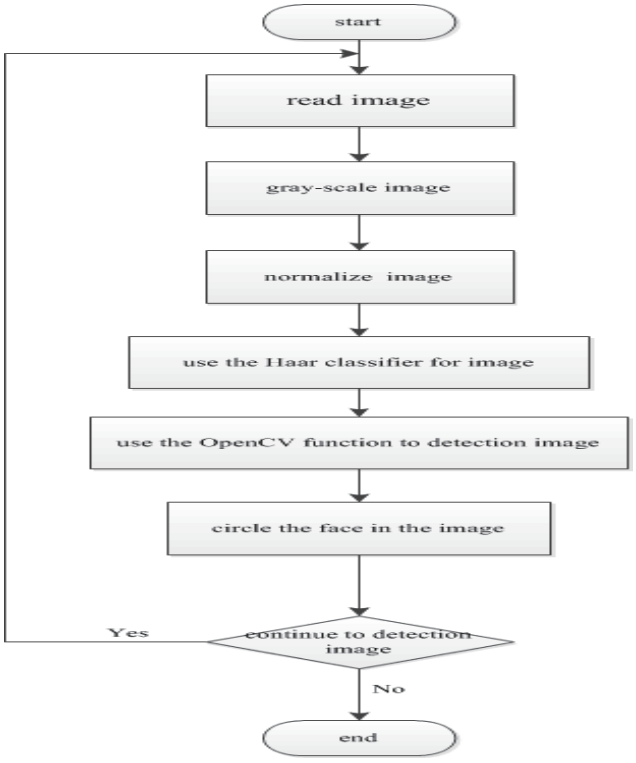


Fig. 1 Program flow chart

A. Gray processing

The process of converting color image into grayscale image becomes the grayscale processing of image. Gray image R, G, B three components of a special kind of same color image, its scope of the change of a pixel 255 kinds, so in the digital image processing of the general will first in a variety of formats image into a gray image in order to make the subsequent image calculation quantity was less. The description of grayscale image can reflect the overall and local color and brightness level distribution and characteristics of the whole image. There are four methods: component method, maximum method, mean method and weighted average method to grayscale color images. In this experiment, we used the weighted average method, therefore, according to (1) equation [3], RGB is three.

The weighted average can get a reasonable gray image.

$$J(x, y) = 0.299R(x, y) + 0.587G(x, y) + 0.114(x, y) \quad (1)$$

B. Standardization of histogram

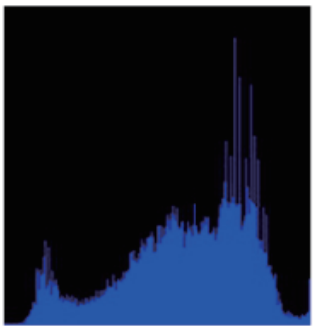
Histogram normalization is a technique that USES all possible color ranges to elongate image contrast [5]. In this method, two pictures with different hues are normalized by histogram, and the tone of one image can be drawn into two images. As shown in Fig. 2, Fig. 2 (a) display the result image before normalization, and Fig. 2 (c) display the result image after normalization. This will help to overcome the dimming of the light or the lighting conditions.

In the Visual Studio 2015 platform software, functions are used to complete the above process. The normalized histogram effect is shown in Fig. 2; Fig. 2 (b) display that there is no normalized histogram, and Fig. 2 (d) display the histogram after normalization.

(a) specification before image

(c) specification after image

(b) specification before histogram



(d) specification after histogram

Fig. 2 Standardization of histogram

C. Haar-like Feature extraction

The haar-like feature is a piece of information about the local appearance of the encoding object [6]. The images are classified according to these eigenvalues, instead of using pixels directly. Because the eigenvalues provides information about the image, the whole image can be used to calculate it.

The haar-like feature can construct many feature patterns, but only four patterns are used. These patterns are shown in Fig. 3. The feature of the two rectangles is that the pixels of a rectangular area subtract the same size from the adjacent rectangular area, which can be vertical and horizontal. A three-rectangle feature consists of three adjacent rectangles, which compute the sum of two outer rectangles and subtract them from the pixels of the central rectangle. It has two types, horizontal and vertical. Finally, a four-rectangle feature calculates the difference between diagonal pairs of rectangles. [4].

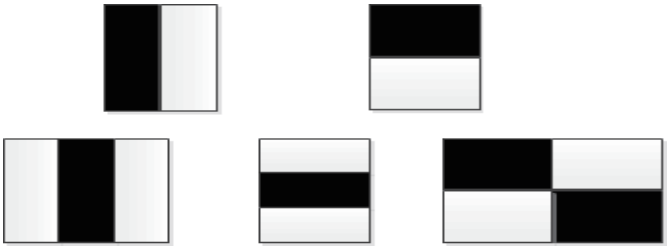


Fig. 3 Haar-like Feature extraction

III. The Experimental Process

In this experiment, I chose the lighting environment for indoor viewing. Fig. 4 is the distribution diagram of indoor lamps; I use a logitech C310, CMOS sensor, camera is 5 million pixels, the dynamic resolution of 1280 * 720, joint type is USB 2.0 focusing is a Fig. 5 for the camera image.

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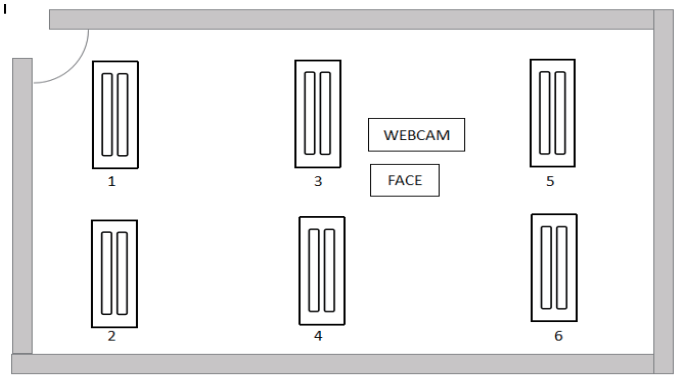


Fig. 4 Indoor lighting distribution

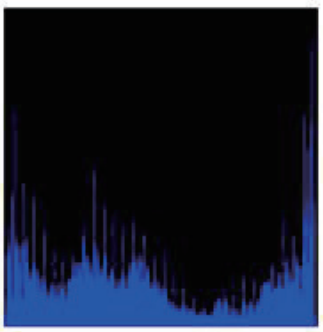
Fig. 5 Camera diagram

IV. The Experimental Results

Fig. 6 display the results of the 1、2 lamps and the remaining lights; Fig. 7 display the result of the 3、4 lamps and the remaining lights; Fig. 8 display the identification results of 5、6 lamps; Fig. 9 is a full brightness result graph; Fig. 10 display the results of the complete extinction of lights.

(a) original image

(c) gray-scale image



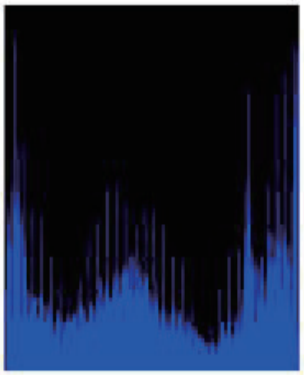
(b) histogram

(d) results image

Fig. 6 The 1 and 2 lamp illuminates the result graph

(a) original image

(c) gray-scale image



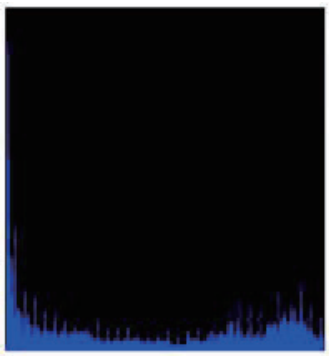
(b) histogram

(d) results image

Fig. 7 The 3 and 4 lamp illuminates the result graph

(a) original image

(c) gray-scale image



(b) histogram

(d) results image

Fig. 8 The 5 and 6 lamp illuminates the result graph

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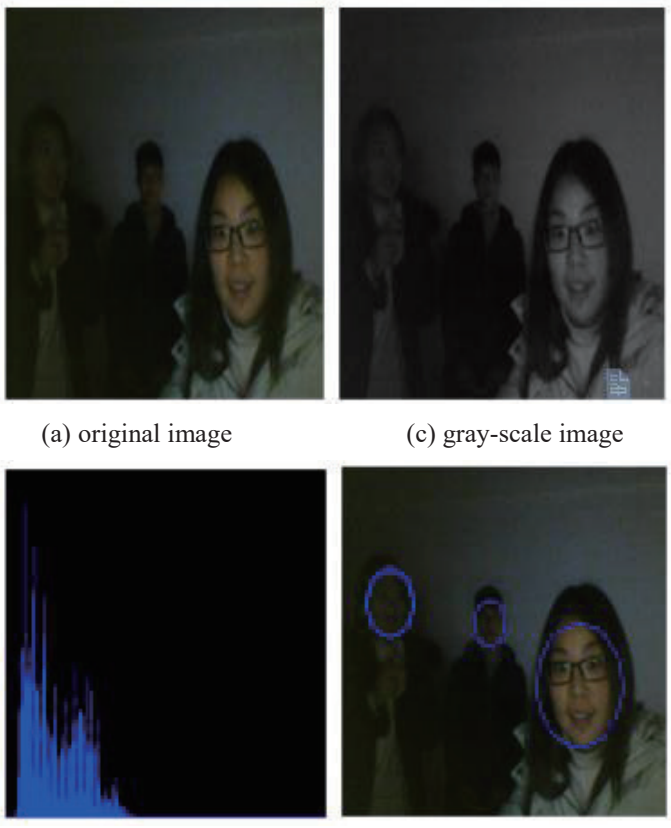
(a) original image (c) gray-scale image

(b) histogram (d) results image

Fig. 9 Full brightness result graph



(a) original image (c) gray-scale image

(b) histogram (d) results image

Fig. 10 The lamp completely extinguishes the result graph

V. Conclusion

Computer vision in the future will be of great development, and detection technology is a worth exploring field. It is proved by experiment that the image processing method used in this paper has completed face recognition under different lighting conditions, which is an important breakthrough in face recognition technology.

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