A Study on Preprocessing Improvement Method for Face Recognition

Yang-koo Lim, Duck-jae Chae, Sang-Bum Rhee
Dept. of Electronic Eng.
Graduate School
Dankook University

Abstract

A face recognition is currently the field which many research have been processed actively. But many problems must be solved the previous problem.

First, We must recognize the face of the object taking a location various lighting change and change of the camera into account. In this paper, we proposed that new method to find feature within fast and correct computation time after scanning PC camera and ID card picture. It converted RGB color space to YUV. A face skin color extracts which equalize a histogram of Y ingredient without the Luminance.

After, the method use V' ingredient which transforms V ingredient of YUV and then find the face feature. The result of the experiment shows getting correct input face image from ID Card picture and camera.

1. Introduction

The study of face recognition using computers began 20 years ago. Face recognition has wide application area such as, personal identification, criminal identification system, security system.

Also nowdays, the development of hardwares leads to generalization of computer technique and development of computer graphics. This causes increment for the research of more friendly and actuality personal interface. Accordingly, existing interface between person and computer rely upon input/output devices, but nowdays, using intellectual interface such as voice, character, face recognition are carried out actively. As example, in flight simulation, finding the fragment using the pupil of pilot's eye, and display it in more higher quality of texture, can help pilot with his decision making. Also, with persons head movement, can control the cursor in a monitor instead of using a mouse. Also it can be used in driver's anti-sleeping system, personal computer for handicapped.

Face recognition system study can be divided into 4 subject. Study about face line abstraction from input image, study about important parts(ex. nose, mouth) image abstraction, identifing person by expositing face image, and study about recognition expression of persons image.

The important characteristic that can be abstracted from a full face include eye, nose, mouth[8]. This method proved reliance face recognition only on still images such as photo. Recent research shows using old fashioned face recognition method can obtain transformable face model which is graft

together by face recognition and psychology. Turk and Pentland used a method called Eigenvalues analysis to find face location and recognizing it[9]. Yullie used Deformable template which used transformable Meodel's parameter. [10]. Bruneli and Poggio compared between Template matching and Feature matching and showed Template matching has better results[11]. And also edge detection, shade conversion were used on finding mouth, eye, nose location experiments. Defining movement between face expression technique were developed. Expression analyzing needs a model for observing movements and method for tracing it. Well known and still used technique for this is key-framing approach by Parke[12]. This method uses 2 or more image and interpolation technique and calculate the middle information. Platt and Badler developed fragment of face image model[13]. This model presents face by linked dots and these dots are linked with muscular motion model which has flexibility and contraction. This model is applied to face expression which linked to face muscles.

Edge detection and edge connect method comes out rarely on face images in line between eye and mouth which is a ideal shade change from object abstracted by edge detector. Further more, organizing global edge by using local edge information is hard work. Hough transform is a powerful tool for shape analysis because it shows good results on analyzing situation when material outline or curved, straight lines are expressed by parameter.

Abstracting accuracy is totally depend on the size of quantity parameter space. There are two different types in the knowledge-based methods. One of the ways is to get all informations about the specific feature of eyes, eyebrows ,nose and mouth using statistical data on their locating in the face. The other one is to locate them in the face using the information about geometrical shape of the eyes, eyebrows, nose and mouth. The most well-known types of the letter are deformable template matching method and active counter method. The method of deformable template matching is used to abstract the specific feature of regular-shaped organs like eyes and mouth. Eye and mouth can be drawn using a couple of parabolas, ovals and circles. As they have certain type of geometrical shape, this fact makes it possible for eye and mouth to be drawn as a parameter. The figures of the parameter are adjusted to create specific feature of two exposed image. Their methods are effective way to abstract clear specific feature, it takes preliminary knowledge and long time to do algorism. Active contour is introduced to abstract to abstract vogue edge. It is and energy minimized spline and is introduced by outside power. The power of image makes splines and edges. In the way of abstracting special feature using model face to search, in specific part of made by closed circle lines was picked out high density of grey level and was set as a target area to search. The location of the eye and eyebrow has figured out using symmetry of the face. In this way, a simple way to locate the target spot can save processing time. However it has a weak point too. It is not useful in the image with glasses and in case the brightness is not same between both side of the exposed image. In this paper, skin area is picked out using element Y equalized in histogram and UV element after changing input image in the RGB color space into YUV space.

The figure of element V changed is used to

find out the eye spot. The effective way to pick out the location of the eye using symmetry of two eyes was presented. In addition, using variety methods of abstracting facing location and symmetry of face, mouth, eyes makes possible to abstract the nose location. This paper consists of these followings. In chapter 2, analysis of faceline abstraction experiment examples. In chapter 3, presentation of special point abstraction method. In chapter 4, experiments using special point abstraction method and comparing and analyzing it with other methods. In chapter 5,conclusion.

2. Skin territory detection

To detect face from a picture of a ID card of camera image, RGB value from input picture should be changed to YUV color space using method(1). Y is very sensitive to light because it has brightness value. So as an example, to minimize the noise made by watermarking, Y has to be equalized by Histogram and detect territory by skin color with UV.

$$\begin{bmatrix} Y \\ U \\ V \end{bmatrix} = \begin{bmatrix} 0.257 & 0.504 & 0.098 \\ -0.148 & -0.291 & 0.439 \\ 0.439 & -0.368 & -0.071 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \quad (1)$$

2-1 y component of Histogram equalization

Image which has unequal value of brightness can improve image by using Histogram equalization process. The object of Histogram equalization is to produce equal value Histogram program. Distribution of skin territory color and UV is used in finding skin color. Using method(4) with Y element, Histogram equalization.

$$P_k(r_k) = \frac{n_k}{n}, \quad 0 \le r_k \le 1 \quad (2)$$

$$k = 0, 1, 2, \cdots, l-1$$

1 is quantity of discrete numerical which shows brightness,r_k is k th brightness. n is number of pixels in full image, n_k is number of pixel which brightness is r_k.

$$s_k = \sum_{j=0}^{k} \frac{n_j}{n} \quad (3)$$

In other words, frequency. [picture 1] (a) is Y from RGB using method(1), (b) is picture from Histogram equalization using method(4).

$$s_k = E(r_k) = \sum_{j=0}^{k} \frac{n_j}{n} = \sum_{j=0}^{k} P_r(r_j) \quad (4)$$

(a) (b)

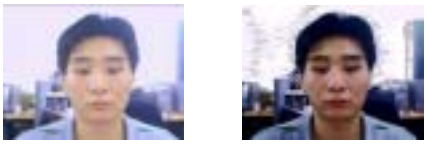
[Fig. 1] Histogram equalization of Y element

2-2 Skin color detection using YUV

Decreasing brightness ingredient effect in Y ingredient makes [picture 2] (b). Re-express YUV to RGB so it can be judged by human eyes and detect skin color.

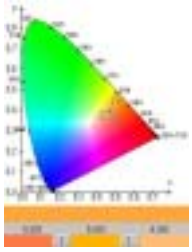
$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 1.164 & 1.596 & 0 \\ 1.164 & -0.391 & 0.813 \\ 1.164 & 0 & 2.018 \end{bmatrix} \begin{bmatrix} Y-16 \\ U-128 \\ V-128 \end{bmatrix} \quad (5)$$

Put U and V in method(5) and put Y in Histogram equalization Y and show image which is not affected by brightness ingredient. In [picture 2], (a) image is from camera input and (b) image is Y which is Histogram Image.



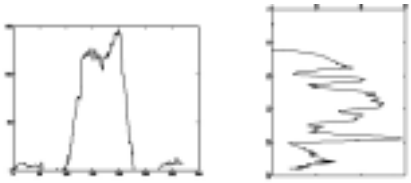
(a) (b)

[Fig. 2] Input image and Y element histogram equalization image



[Fig. 3] Chromaticity Diagram

[Fig. 4] Skin color extraction



(a) (b)

[Fig. 5] Skin color x sign, y sign region distribution

Now detect skin color from (b) image, 3 parts of block color from [picture 3] were used. As you see in [picture 4], It is a graph of skin color territory.

Fig. 6] Face region extraction

3. face characteristic abstraction

3.1 eye location abstraction

Generally, discrete is used to find the eye location. But in dark backgrounds or in with the color similar to eye colors, a lot of errors. Also not only the eye, but such as mouth, nose has to be very noticeable not to show errors.

$$V' = [-0.439 \times R] - [0.368 \times G] - [0.071 \times B] + 128 \quad (6)$$

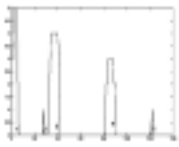
In method[6] V is changed to V' because V is very sensitive to R in RGB color, so R times -1 makes R smaller so that the eye, nose, mouth shown more skillfully.

(a) (b)

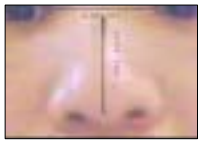
[Fig. 6] V element and V' element

[Fig. 8] V' of face region of [Fig.

[Fig. 9] y sign location of eye



[Fig. 10] x sign value of [Fig. 9]



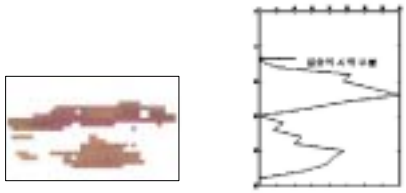
[Fig. 11] Extraction image of both eye

In [picture 8] eye shows symmetry and the color is gray. As shows in [picture9], using these characteristics makes able to find the

eye location. [picture 10] shows 3, 4 are eyes and its symmetry. In [picture 10], 1 is the starting point, so it could be shown as hair. Also it's not symmetry, It can not be sure that it's a eye.

2, 5 in [picture 10] has no information needed so it can be analyzed as noise.

If line L is the distance between eyes, and L' is the line veridically starting in the center of line L. In line L'. It has the nose characteristics. Using this method, mouth territory can be found starting from L'.



(a) (b)

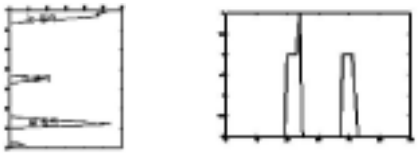
[Fig. 12] Lip region with distribution

[picture 12] (a) is the mouth territory. But separating the skin color from

[picture 12] (a) is the mouth territory. But separating the skin color from mouth territory is not easy. y-axis should be saved as (b) in [picture 12].

(a) (b)

[Fig 13] preprocessing for feature extraction



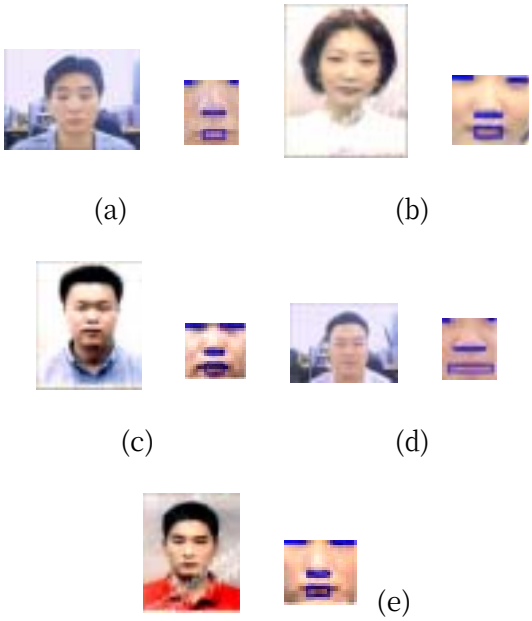
(a) (b)

[Fig. 14] feature distribution in [Fig.13] (b)

[picture 13] (b) is from (a) discrete.[picture 14] (a) is [picture 13] (b) it's y-axis distribution value. [picture 14] (a)shows division in eye, nose, mouth territory. [picture 14] shows nose territory's x-axis distribution. nose territory Shoul be symmetry.

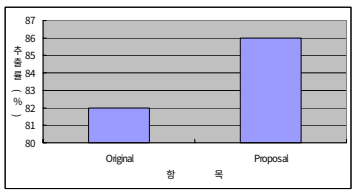
4. experiment and results.

This paper carried out an experiment in abstracting facial characteristic from scanned picture from ID card and PC camera. Experiment equipment were Intel cs330 PC camera and BizCardReader 600c. The size of the PC camera image was320*240. Also the image from BizCardReader 600c was 450 DPI. [picture 15]shows the result of execution of this paper algorism.



(a) (b) (c) (d) (e)

[Fig. 15] Input image and result image



[Fig. 16] Total extraction rate about original image, YUV transform image

The result shows good abstraction ability. But, an error occur in character abstraction when the image has black-rimmed glasses or has lots of make-up on it.

5. conclusion & after study assignment

In this study YUV is used abstract face characteristic. It showed the method to find face territory & characteristic using YUV conversion.

In face image with glasses, face characteristic was abstracted. It solve the brightness value influence problem which had in existing method. Therefore, existing method is too complicated and too much reliable on statistical data, but this new method showed the easy way and variety application.

Hereafter study should be made to improve the method of territory abstraction using skin color data and to minimize the noise reduction in watermarking with ID Card.

6. Reference

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