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Removing the effect light from image and human face detection

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ABSTRACT

Recent years have attention commencement in the most of the facial animation applications therefore the proposed technic of the way to remove the effect of light from the image by a series of steps in accordance with the algorithm and human face detection.In this paper, a new method is displaying the removing effective light for human face detection. It contains two parts: lighting compensation and skin color model. First we offset the high light existing in human face images and removing high light and shadow, second depending on the mechanism of Skin color classification and the morphological segmentation is used to detect face(**s**) after removing the effect light. This part consists of face detection from during face segmentation and facial feature extraction.

1. Introduction

In the recent year, many researchers have been motivated to develop efficient face detection algorithms. The most successful one was proposed by Viola and Jones's issues two important of affect light on human face detection by skin color model [1 **]**. Face detection is important due to the wide variety of applications such as public security, video surveillance, and access control. Face detection is often preceded by the extraction of skin-tone colors **[2]**, It is one of the most important cues of the face features with invariance of the changes of face scales, poses, and facial expressions. However, the color-based approaches are quite difficult to robustly detect skin-tone color in the presence of complex background and varying illumination **[3].**

The fact that shed light on the skin optics has a big impact on the quality and clarity of image and because the "Skin Optics" which appearance The incredible kaleidoscope of human skin color is due to each individual's unique dermal concentration and distribution of skin chromophores, molecules that absorb or reflect light. While a number of chromophores are present in human skin, various models of skin optics**[4], [5]**.

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In this work Skin color classification and morphological segmentation are used to detect faces after removing the high light offset to exist in human face images, in the first frame by using the position of the faces as the marker detecting the skin in the localized region, with a number of parameters describing the shape or motion of the face **[6]**.

2. Lighting Compensation

Human face is part of the skin color, which is affected by light, reflections and the nature of angles face. In this paper, light compensation and nonlinear transformation of chroma is introduced.

2.1 Removing Color Offset

Here the image is suffering from adjustment of color when the number of pixels and high-density high enough **(> 500)** **[7]**. I depends on approach proposed by gray World that the ratio between the respective average of images components in these pixels is larger than. To remove the color offset [8], [9].

① **Compute the average of Images components as $avgI_1$, $avgI_2$, $avgI_3$, and get the average gray value.**

$$avgGray = (avgI_1 + avgI_2 + avgI_3/3) \quad (1)$$

② **Denote** $\alpha r = avgGray / avgI_1$, $\alpha g = avgGray / avgI_2$

$$a_b = avgGray / avgI_3 .$$

Then adjust $c(I_1)$, $c(I_2)$, $c(I_3)$ for every pixel c by (2).

$c(P) = c(I_1) \cdot \alpha_\iota$ **(2)**

Where $P = I_1, I_2, I_3$, $p = i_1, i_2, i_3$ respectively.

③ Normalize the corresponding Images components

$c(p) = c(I_1) / factor$ *(3)*

2.2 Removing High light and shadow

To build a skin color model in **YC_rC_b**, ordinary method is to exclude component **Y** and search in two-dimensional **Cb-Cr** for skin color cluster region **[10]**.

The transformed equation from space **YCrCb** to the new space **YC2rC2b** is as **(4)**.

$$C_i(y) = \begin{cases} (C_i(Y))\dfrac{Wc_i}{Wc_i(y)} + C_i(Y) & if \quad y < k_i \quad or \quad y > k_h \\ C_i(Y) & if \quad y \in [k_i, k_h \end{cases} \qquad \textbf{(4)}$$

Where, ***i*** denotes ***b*** or ***r*** , ***$C_i(Y)$*** is axle wire of skin color region, ***Wc_i (Y)*** is the width of the skin color region, and they are two piecewise functions, **125, 128** ***l h K = K =*** are their subsection domain value.

For simplicity, we also denote the new space **YC_rC_b asYC_rC_b. Figure (2).**

2. Skin Color Modeling

The choice of color space can be considered as the primary step in skin-color classification. The Hue-Saturation-Value **(HSV)** color space, is very similar to the human perception of colors. It can be used for face detection. Any other color space can be obtained from a linear or non-linear transformation from **HSV**.

2.1 Color Space Transformation

The color space transformation is assumed to decrease the overlap between skin and non-skin pixels thereby aiding skin-pixel classification and to provide robust parameters against varying illumination conditions. It has been observed that skin colors differ more in intensity than in chrominance **[11]**. Hence, it has been a common practice to drop the luminance component for skin classification. Several color spaces have been proposed and used for skin detection. In this section, we review the most widely used color spaces for skin detection and their properties

3.2 Connected analysis

In this paper, the paradigm of *Adaptive Neighborhood* **(AN)**, proposed by Gordon and Rangayyan was used in various image filtering processes **[12]**, **[13, 14, 15]**. In *Adaptive Neighborhood Image Processing* **(ANIP)**, *a set of adaptive neighborhoods* **(ANs set)** is defined for each point of the studied image. The spatial extent of an AN depends on the local characteristics of the image where the seed point is situated. Here depend on a 8-connected neighborhood. Where **if a skin pixels has got another pixels in any of its 8-neighboring places, then both the pixels belong to the same region. Repetition of this steps until scan all the pixels in the image.**

Here, group pixels that are connected to each other geometrically. As a result of the different regions that we can get the classification eventually lead to regions of the face or not.

4. Face Detection

This part presents perform face segmentation by threesholding the color input image using predefined domains of hue and saturation that describe the human skin color. While research on shape is elliptical or not by connected component analysis . Figure **(1)** result **(show the face detection)**

4.1 Face Segmentation

The segmentation of the face of complex scenes can be done robustly on the basis of color and shape information **[16]**. The most **(RGB, HSV, YUV and HLS)** used for the segmentation of skin like regions. Where use hue and saturation to segment regions with human skin color and perform connected component analysis on the image segmentation. producing the oval shape of faces can be approximated by ellipses.

$$V = \frac{\sum_{(X,Y)\in E}(1 - b(x,y)) + \sum_{(x,y)\in C\setminus E} b(x,y)}{\sum_{(x,y)\in E} 1}$$

Where

$$B(x,y) = \begin{cases} 1 & \text{if } (x,y) \in C \\ 0 & \textbf{otherwise} \end{cases}$$

C, **V** determines the distance between the connected component and the best – fit ellipse by counting the holes of the ellipse and the points of connected component. Table **(1(c,d))**.

4.2 Facial feature extraction

This paper shows that facial feature extraction is depend on the noticing that, in intensity images, facial features differ from the rest of the face . Where in the eye, Whys for the are the color of the pupils and the sunken eye sockets. The lips emphasizes the mouth against appear the light red color which surrounding region. Therefore getting information from the interior of connected component where getting better facial feature by applying grayscale erosion and extremum sharpering operation.

5. Analysis

For the analysis of the steps of the previous work to describing filtering process which use geometrical properties of the connected components. However, In order to determine appropriate for detection of face, According to information textures two connected operators which uses a decision criteria are based on the original image texture inside the support of the connected components. While, closed the holes inside the connected components.

Because of the presence of the eye and mouth in the face area, it shows a certain difference in luminance, this property can be applied to a connected operator on the basis of variation in the internal luminance the support of the connected component.

In the arbitrary shaped regions there are the compute the Mahalanobis distance, by creating a ellipse sub image which contains the original image texture of the region defined by the connected component. This image continent on facial features is extracted by the analysis of minima and maxima. To evaluate the images of the topographic greylevel relief of the connected component, Where the y-image is determined by computing the mean greylevel value of every row of the connected component; The minima and maxima are searched in the smoothed y-relief. For each significant minimum of the y-relife, x-relife are coputed by averaging the greylevel values of the 3neighboured rows of every column. After fining the x-relife minima and maxima are determined. Its to leading to find facial feature candidates.

6. The Results

The algorithm is applied on typing different images which are taken under effect lighting. In this research removing the effect light, pixel detect as skin, face segmentation and facial feature extraction as final result. The figure **(1)** show the face detection.

7. Evaluations

Table **(1)** shown the evaluation for each image in this way by removing effect of light from the image or not**.**

8. Comparison

To make a comparison between the way the method used with the performance of the ways synonymous through the following browsing for approaches:-

1) **Colour – induced relationship between affect and reaching kinematics during a goal – directed aiming task (2011):-**

In order to explore the role of colour in the relationship between affect and action, participants donned different pairs of coloured glasses (red, yellow, green, blue and clear) and completed positive and negative affect scale questionnaires as well as a series of target-directed aiming movements.

2) **Broken Time Reversal of Light Interaction with Planar Chiral Nanostructures (2008):-**

This method includes unambiguous experimental evidence of broken time reversal symmetry for the interaction of light with an artificial non-magnetic material.

3) **Fast Head Pose Estimations under Different lighting Conditions (2004):-**

The main work in this research is to detect the faces under these complex situations and reduce the influence of different lighting.

4) **Position Detection of Multiple Light Beams Using Phase Detection (2000):-**

This technique is capable of displaying multiple perspective views at high resolution because the number of views only depends on the number of light beams.

5) **A Novel Method for Face Detection across Illumination Changes:-**

In this method is proposed for human face detection. It contains three parts: illumination compensation, skin color model and template matching.

Figure 1 (a) Original image (b) Remove Affect (c) Skin Segmentation (d) Result of face detection

Table 1 examples evaluation

Number of Image	Evaluation	Comment	Face Detected
1	True	Remove effective on the picture	True
2	True	Remove effective on the picture	True
3	True	Remove effective on the picture	True
4	True	Remove effective on the picture	True
5	True	No effective on the picture	True

Removing effect the light:

Step 1: after inserted the RGB images from video or camera as input.

Step 2: the number of pixels and high-density high enough (>500).

Step 3: ratio between the respective average of RGB components in these pixels is larger >1.

Step 4: in this step removing the effect light depend on.

- **Compute the average of RGB components**

$$avgGray = (avgI_1 + {}_{avI2G} + avgI_3)/3$$

- Denote $\alpha i_1 = avgGray/avgI_1$, $\alpha i_2 = avgGray/avgI_2$

$$\alpha i_3 = avgGray / avgI_3$$

$$c(P) = c(I_1) . \alpha_\iota$$

- **Normalize the corresponding Images components**

$$c(P) = c(I_1) / factor$$

Step 5: in this step removing high light and shadow

- $$C_i(y) = \begin{cases} (C_i(Y))\dfrac{Wc_i}{Wc_i(y)} + C_i(Y) & if \quad y < k_i \quad or \quad y > k_h \\ C_i(Y) & if \quad y \in [k_i, k_h \end{cases}$$

Figure (2) Removing effect the light from image.

The proposed algorithm:

Step 1: inserted the images from video or camera as input.

Step 2: the effect removing from image which consist of: removing color offset from image

- **High light and shadow removing.**

Step 3: decided whether each of the skin regions identified as a face or not.

- **classify each pixel in the first image as a skin pixel or non-Skin pixel.**
- **identify domains of hue and saturation for skin segmentations and facial feature extraction by using connectivity analysis.**
- **Connected component which are well approximated by their best-fit ellipse are considered as face from by using function of C. V determines the distance between the connected component.**

Figure (3) Proposal algorithm

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أزاله تأثير الضوء من الصورة وتحديد وجه الإنسان

عبد إبراهيم مصلح

الخلاصة

في السنوات الاخيرة بدء الاهتمام في اغلب تطبيقات الصور المتحركة الوجهية لذلك الغرض من التقنية أزالة تأثير الضوء من الصورة بواسطة سلسلة من الخطوات وفق خوارزمية ثم تحديد وجه الانسان. في هذا البحث طريقة جديدة لأزالة تأثير الضوء الفعال لأجل تحديد وجه الإنسان. يحتوي جزئين: أضائة التعويض ونموذج الجلد الملون. أولا نعدل الضوء العالي الموجود في صور وجه الانسان وأزالته مع الظلال ثانيا اعتمادا على الية تصنيف الجلد الملون والتقطيع المظهري يستعملان لتحديد الوجه بعد ازالة تأثير الضوء. هذا الجزء يتألف من تحديد الوجه من خلال تقطيع الوجه واستخراج ميزة الوجه.