International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 23 Issue 1 –JUNE 2016.

FACE RECOGNITION USING SKIN COLOR SEGMENTATION OF YCBCR AND RGB COLOR MODELS

Mrs. Chinmaya Bari[#1] and Dr. T.N.Ghorude[*2]

[#] *M Sc.(IT), B.Ed. Department of CS & IT, N.B. Mehta Science College, Bordi , India*

[*] *M.Sc.(Physics), Ph. D, Department of Physics, N.B. Mehta Science College, Bordi , India*

***Abstract*— For the past decades, there has been a tremendous growth in the study of segmenting the skin regions in color images. Face Recognition via skin color segmentation is one of the challenging issues in image processing. In this paper, we make a study in skin color segmentation to recognize the faces. We develop a skin color model algorithm that comprised of color similarity in skin, segmentation of skin, template matching and morphological operation. From a variant ethnic group, the skin samples are acquired. Gaussian Probability density is estimated using maximum similarity factor of the acquired skin samples. The detected skin region is further segmented via Adaptive thresholding. The skin features are extracted by performing some mathematical operations in order to eliminate the noises present in the samples. Two schemes named, YCbCr and RGB color model. Experimental analysis is conducted over the human face that achieves better detection accuracy, better detection speed and lessened false positive rate. Atlast, it is concluded that the YCbCr model performs better than the RGB color model.**

***Index Terms*— Gaussian probability density, Skin segmentation, Skin color models and Face recognition**

I. INTRODUCTION

The appliance of skin segmentation is being used commonly in all areas of computer science and its purposes [1] [2]. Detecting and monitoring face and palms are major for gesture consciousness and human computer interaction. The purpose of skin detection is to extract the epidermis pixels from image by the way of making use of the great category of skin segmentation algorithm. Here, skin segmentation is a method of segmenting the pixels of a photograph into dermis and non-dermis regions. The algorithm must be capable enough to make a decision a couple of particular pixel into epidermis regions or non-epidermis areas.

In any given color house, how intelligently classify and extract the dermis related pixels rely on the correctness of the algorithm. After extracting the dermis-pixels from a regions of a picture, then there may be must condition to switch into exceptional color items if the quality if a snapshot is just not right adequate, within the context of epidermis segmentation. The classification of epidermis pixels into the skin regions is very important and false optimistic premiums should be as decrease as viable. There's perpetually a potentialities, that a skin pixels is been detected in non-dermis regions or the visualization of an picture is no longer just right enough which investigate to use the switching situation to change it exceptional color models.

The Gaussian parametric models assume that dermis color distribution may also be modeled by using elliptical Gaussian joint chance densities methods. Nonparametric ways estimates epidermis color distribution from the histogram of the training knowledge without deriving an explicit model of skin color segmentation the simplest, and commonly utilized, approaches construct what is called an “explicit skin cluster” classifier which expressly defines the boundaries of the skin cluster in targeted color areas. The underlying speculation of methods centered on specific dermis clustering is that dermis pixels exhibit similar color coordinates in an effectively chosen color house. These binary approaches are very fashionable, as they are convenient to enforce and do not require a coaching phase. The most important obstacle in attaining high dermis recognition rates with the smallest viable number of false positive pixels is that of defining correct cluster boundaries by means of easy, generally heuristically chosen selection rules.

The paper is organized into four parts. Section II describes the various studies conducted by other researchers. Section III describes the proposed algorithm. Section IV describes the experimental analysis and at last concluded in section V.

II. LITERATURE SURVEY

There are numerous approaches for skin color segmentation, such Gaussian model, color histogram, and thresholding. One of the crucial skin detection approaches that undertake the edge method can be discussed in this paper. Sobottka and Pitas [3] presented an approach for dermis color segmentation established on HSV color house utilizing constant threshold values to extract the face region. As a result of the variation in light stipulations, they adopted face structure to increase the face detection feature. Jusoh et al. [4] offered a method for dermis color detection, which is headquartered on HSV and RGB color spaces, to fortify the segmentation system by using making use of two thresholds. The primary threshold is utilized to the hue channel, and the other threshold is applied to the RGB model. An additional method that combines two color items (HSV and YCbCr) used to be proposed via Ghazali et al. [5] for extracting the face neighborhood. It is centered on thresholding procedures. Segmentation via combining more than one color model improves the accuracy of skin detection.

Ghotkar and Kharate [6] described a hand segmentation system through making use of a threshold procedure for hand gesture awareness. They made a comparison between three color areas (HSV, HSL, and HTS) and determined that the final one gave better outcome than the others. Jagadesh et al. [7] awarded a process for dermis segmentation using the bivariate Pearson an sort-IIb combination model. They used the hue and saturation accessories of HSV color space to distinguish the epidermis and non-epidermis pixels, which they founded on the brink values and the probability approach, to enhance the accuracy of the outcome. Nevertheless, using HSV color house in skin segmentation is time ingesting as a result of the time. It takes for non-linear transformation to arise between the RGB and HSV color items.

Chai and Ngan [8] suggested a procedure for extracting the face area from an input image making use of the thresholding procedure. The color house used in this technique is the YCbCr color mannequin. It was used because of its efficiency for modeling skin color and for its use in video coding. Additionally, they studied about the use of YCbCr color area with fixed thresholding to extract the face area is described via Marius et al. [9]. It applies morphological operations to slash the unwanted regions. However, dermis detection using the YCbCr cooler mannequin in the prior methods is unsuitable for some races, reminiscent of black folks.

Kukharev and Nowosielski [2] extracted the skin areas through using the RGB and YCbCr color spaces to give a boost to the accuracy of the epidermis detection. For speedy face segmentation de Dios and Garcia [10] proposed YCbCr color model with two thresholds. Even though, they develop a better face detection model by using rotating the Cr and Cg axis within the chrominance channel, the process of conducting segmentation at a greater level of accuracy. Almohair et al. [11] offered a process to differentiate the human skin from the color photographs that contain luminance. They did so by using making use of the thresholding procedure, which is viewed to be an effective device for boosting the segmentation process. A brand new color model for epidermis segmentation that's founded on RGB color area has been introduced to pace up the approach of classifying the pixels by means of changing the 3D area of RGB to 1D. This approach uses the thresholding process to distinguish skin pixels from the non-epidermis pixels. Although the segmentation is rapid, the outcome must be improved due to the absence of the red channel [1].

III. PROPOSED METHODOLOGY

Before developing an algorithm, let us study about the basic definitions of variant color models.

A. *YCbCr Color model:*

This color model consists of Y channels that represent the luminance component. The Cb and Cr channels represent the chrominance component. The variation of luminance from chromatic channels makes a better skin color model. The transmutation from RGB color space model to YCbCr model is efficient and easy. It is given as follows:

$Y = 0.299R + 0.587G + 0.114B$

$Cb = (B-Y) * 0.564 + 128$

$Cr = (R-Y) * 0.713 + 128$

By using the threshold values, the skin pixels are extracted as follows:

$135 < Cr < 180$

$85 < Cb < 135$

Y> 80

A. RGB COLOR MODEL

As the name suggests, it contain three color spaces like, Red (R), Green (G) and Blue (B). This model is more prone to the sensitive noises. Depends upon the threshold value, the RGB color space model is given as follows:

R>95 & G>40 & B>20

Max(R, G, B) - min (R, G, B) >15

|R-G| > 15 & R>G &R> B

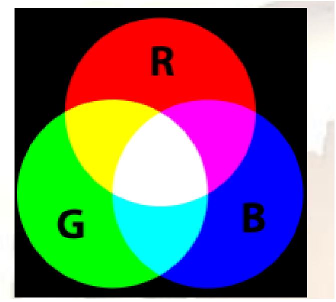

Fig.1. RGB Color model

Then, the skin color segmentation using YCbCr color model is performed as follows:

a) Input Image: Human faces
b) Transform the input image to YCbCr model.
c) Based on defined threshold values, the colors in the images are classified.
d) A clustered image is formed from the classified images.
e) Then each pixel in clustered image is labelled.

Similarly, the RGB color model is described as follows:

a) Input image: Human faces
b) Splitting the colors in the image into RGB components
c) The output in RGB components is converted into RGB matrices.
d) Again it is transformed into gray-scale intensity image.
e) Depending on threshold values, the targeted skin regions are classified.

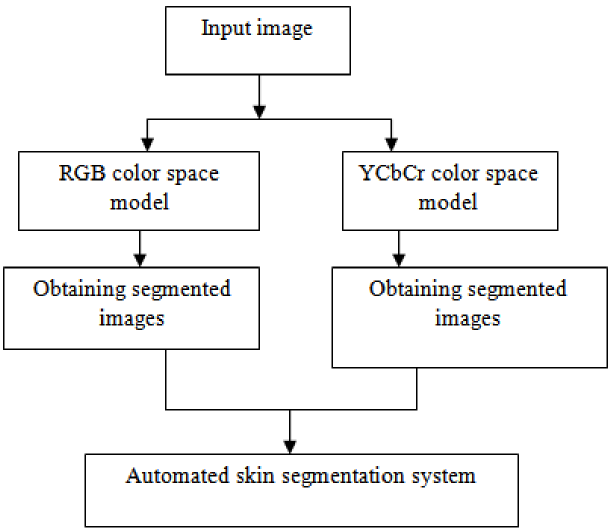

Fig. 2 Proposed flowchart.

IV. EXPERIMENTAL RESULTS

The proposed method is tested using the human face images obtained from Wild Home database. Each image size is of 250 * 250 with clear picture quality. It also consists of different races of people. Through the analysis, we prove that the proposed scheme detect the skin efficiently with the least false positive and false negative rates.

Fig.3. Original images

Fig.4. YCbCr model

Fig.5. RGB model

a) Detection Rate:

The number of skin pixels correctly identified (N_s) to the aggregate number of skin pixels (N_f) is known as Detection Rate.

$$DR(\%) = \frac{N_S}{N_F} * 100 \quad (1)$$

b) False Positive Rate (FPR):

It is the number of non-skin pixels that are incorrectly identified as skin color (N_{fp}) to the aggregate number of skin color pixels (N_{nf}).

$$FPR(\%) = \frac{N_{fp}}{N_{nf}} * 100 \quad (2)$$

c) False Negative Rate (FNR):

It is the number of skin pixels that are incorrectly identified as non-skin color (N_{fn}) to the aggregate number of skin color pixels (N_f).

$$FNR(\%) = \frac{N_{fn}}{N_f} * 100 \quad (3)$$

Table 1. Performance of the proposed scheme

Method	DR	FPR	FNR
YCbCr	89.647	7.580	10.353
RGB	92.756	4.720	7.244

From the results, we noticed that our proposed method has the highest Detection Rate (DR) value and the lowest False Positive Rate (FPR) and False Negative Rate (FNR) values.

V. CONCLUSION

In image processing systems, the study on skin color segmentation is an important area. Due to the variety of available human races, it is quite challenge task to detect the appropriate human faces. In this paper, we study about the Skin Color Segmentation Algorithm that deals with YCbCr and RGB color space model. From the experimental results, it is inferred that the YCbCr performed better than RGB model to identify the human faces. And, we also obtained better detection rate with least FPR and FNR values. As future work, texture oriented skin color segmentation will be studied.

REFERENCES

[1] A. Cheddad, J. Condell, K. Curran, and P. McKevitt, "A new colour space for skin tone detection," in Proceedings of the 16th IEEE International Conference on Image Processing, Cairo, Egypt, 2009, pp. 497-500.

[2] G. Kukharev and A. Nowosielski, "Visitor identification: elaborating real time face recognition system," in Proceedings of the 12th International Conference in Central Europe on Computer Graphics, Visualization and Computer Vision, Plzen-Bory, Czech Republic, 2004, pp. 157-164.

[3] K. Sobottka and I. Pitas, "A novel method for automatic face segmentation, facial feature extraction and tracking," Signal Processing: Image Communication, vol. 12, no. 3, pp. 263-281, 1998.

[4] R. M. Jusoh, N. Hamzah, M. H. Marhaban, and N. M. A. Alias, "Skin detection based on thresholding in RGB and hue component," in IEEE Symposium on Industrial Electronics & Applications, Penang, Malaysia, 2010, pp. 515-517.

[5] K. H. B. Ghazali, J. Ma, and R. Xiao, "An innovative face detection based on skin color segmentation," International Journal of Computer Applications, vol. 34, no. 2, pp. 6-10, 2011.

[6] A. S. Ghotkar and G. K. Kharate, "Hand segmentation techniques to hand gesture recognition for natural human computer interaction," International Journal of Human Computer Interaction, vol. 3, no. 1, pp. 15-25, 2012.

[7] B. N. Jagadesh, K. S. Rao, Ch. Satyanarayana, and G. V. S. RajKumar, "Skin colour segmentation using finite bivariate Pearsonian type-Iib mixture model and K-means," Signal & Image Processing, vol. 3, no. 4, pp. 37-49, 2012.

[8] D. Chai and K. N. Ngan, "Face segmentation using skin-color map in videophone applications," IEEE Transactions on Circuits and Systems for Video Technology, vol. 9, no. 4, pp. 551-564, 1999.

[9] D. Marius, S. Pennathur, and K. Rose (2003). Face Detection Using Color Thresholding, and Eigenimage Template Matching [Online]. Available: http://scien.stanford.edu/pages/labsite/2003/ee368/Project/slides/ee368group15.ppt

[10] J. J. de Dios and N. Garcia, "Fast face segmentation in component color space," in Proceedings of the International Conference on Image Processing, Singapore, 2004, pp. 191-194.

[11] A. H. K. Almohair, A. R. Ramli, A. M. Elsadig, and B. S. J. Hashim, "Skin detection in luminance images using threshold technique," International Journal of Imaging Science and Engineering, vol. 1, no. 1, pp. 32-35, 2007.

[12] M. S. Iraji and A. Yavari, "Skin color segmentation in fuzzy YCBCR color space with the Mamdani inference," American Journal of Scientific Research, vol. 2011, no. 7, pp. 131-137, 2011.

[13] C. Prema and D. Manimegalai, "A novel skin tone detection using hybrid approach by new color space," International Journal of Computer Applications, vol. 46, no. 7, pp. 15-19, 2012.

[14] J. Kovac, P. Peer, and F. Solina, "Human skin color clustering for face detection," in The IEEE Region 8 EUROCON 2003: Computer as a Tool, Ljubljana, Slovenia, 2003, pp. 144-148 vol.2.

[15] C. Prema and D. Manimegalai, "Survey on skin tone detection using color spaces," International Journal of Applied Information Systems, vol. 2, no. 2, pp. 18-26, 2012.

[16] A. Hanbury, "A 3D-polar coordinate colour representation well adapted to image analysis," in Image Analysis: 13th Scandinavian Conference, SCIA 2003 Halmstad, Sweden, June 29–July 2, 2003.

[17] R. Khan, Z. Khan, M. Aamir, and S. Q. Sattar, "Static filtered skin detection," International Journal of Computer Science Issues, vol. 9, no. 2, pp. 257-261, 2012.

[18] B. C. Ennehar, O. Brahim, and T. Hicham, "An appropriate color space to improve human skin detection," INFOCOMP Journal of Computer Science, vol. 9, no. 4, pp. 1-10, 2010.

[19] D. A. Lyon and N. Vincent, "Interactive embedded face recognition," Journal of Object Technology, vol. 8, no. 1, pp. 23-53, 2009.