International Journal of Computer Science
ISSN:2348-6600
Oddity...Probe...Reviste...
Published by SK Research Group of Companies(SKRGC)

http://www.ijcsjournal.com Volume 3, Issue 1, No 2, 2015. ISSN: 2348-6600
Reference ID: IJCS-080 PAGE NO: 456-459.

Variety of Segmentation Techniques for High Accuracy Object

Mokhtar M Hasan

Department of Computer Science,
College of Science for Women
University of Baghdad
Iraq
mokhtarmh@csw.uobaghdad.edu.iq
mmwaeli@gmail.com

***Abstract*—In order to build a robust model that used to detect and recognize an object in any scene, good segmentation technique should be adopted, in this work we have studied and analyzed two recent segmentation techniques using varies metric parameters to highlights the concealed performance of each of them as well as discover the detailed operation of these techniques, we have presented in this paper the techniques that used Gaussian Mixture Model (GMM) as a basic tools to spot the foreground object based on natural skin color with two different applications for that tool.**

***Index Terms*— Gaussian Mixture Model, Segmentation, Object Detection, Skin Color Extraction, pattern recognition.**

I. Introduction

The locating and extraction of regions that belongs to human skin is done mainly by using skin color segmentation [1], and the best and idea method to locate this hand object is by using vision based techniques [2] which is considered more intuitive as compared with glove based techniques. One of the salient features of the segmentation technique is to produce non-overlapping [3] regions of interest to deal with for the pending operation in the overall system.

Pattern recognition can be done using the preliminary phase which is hand segmentation [4], traffic control system [5], and surveillance [5]. Since the region of interest in the image can detected using the segmentation to ease the image analysis [6]. So, skin color is considered as efficient trait that can be used in segmenting the hand object [7], where this trait is easy to spot and invariant to scale [1, 2], and rotation changes [8]. So, the skin and non-skin pixels can be detected using this skin color segmentation [1, 2].

The quality of segmentation techniques varies depends its outcome, the segmentation techniques for skin color considered outperforms the other when has the ability to recognize between various types of skins such as blackish, brownish [2] under different illumination changes [2].

II. Segmentation Preliminary Steps

The main steps necessary for any good segmentation technique are described as follows [1]:

A. Selecting Color Model:

The most essential step in any segmentation process is the selected color model which in turn will reflect on the application domain type [1][3]. RGB color model considered as the color palette that most researches used to start the segmentation with in images and videos, other color models can be utilized by applying a mathematical conversion from RGB color model to the desired one [10].

B. Selecting Color Model Components:

After deciding the proper color model, the parameters (components) should be selected carefully in a way that shows

International Journal of Computer Science
ISSN:2348-6600
Oddity...Probe...Reviste...
Published by SK Research Group of Companies(SKRGC)
http://www.ijcsjournal.com Volume 3, Issue 1, No 2, 2015. ISSN: 2348-6600
Reference ID: IJCS-080 PAGE NO: 456-459.

the exact representation of the color model, normally the illumination parameter is removed in order to provide a robust segmentation technique for various ethnic groups using two components [1][3][10][11].

C. Modeling:

For modeling the distribution of the skin color, a suitable modeling technique should be considered where the distribution should cover all the skin area in the input image.

III. Segmentation Techniques

A lot of algorithms have been adopted for skin color segmentation process, these techniques variety according to the nature of the problem and application domain required. Different statistical algorithms have been utilized to extract the skin color pixel from the input scene such as Gaussian model (GM) based on parameter estimation of skin color pixel [1][2], non-parametric statistical modeling such as histogram based thresholding [12][13], and Neural networks (NNs) [14]. Furthermore, other segmentation review researches can be found in [15].

In this paper we will discuss two recent parametric statistical skin color modeling techniques, these methods are Multiple of GMM (MuGMM) [1], and Mixture of GMM (MiGMM) [2].

D. MuGMM Technique

In this technique, three different color models have been combined to model the skin color pixel and construct MuGMM method. These color models are normalized RGB, HSV and YCbCr; in this method, GMM have been applied for each single color model and the resulted GMMs will be combined to build new model, the MuGMM model. The foreground color distribution is calculated and trained using 757883 skin pixels and the background color distribution models have trained with 341924 color pixels [1].

The mathematical representation of MuGMM is explained as follows:

$$P(c|skin) = \max_{m \in M} g(c; \mu_m, \sum_m) \quad (1)$$

Where M is the number of color models employed, $(\mu_m, \sum_m)$ are the parameters associated with color model m necessary for single GMM modeling, and $g(c; \mu_m, \sum_m)$ is GMM , and $P(c|skin)$ is the probability of color c being a skin color.

E. MiGMM Technique

In this technique, four color spaces have been utilized; normalized RGB, HSV, YCbCr, and L*a*b* to construct MiGMM model which are the most commonly used for skin color segmentation.

In this method, each color space has been modeled using a single GMM, and the output result of these GMM models are integrated into one superior model by assigning a weight value for the built GMM, this weight is calculated using the classification rate (CR) [2]. The mathematical representation of this model is:

$$P(c|skin) = \sum_{m=1}^{M} W_m \, g(c; \mu_m, \sum_m) \quad (2)$$

Where c, M, m and $g(c; \mu_m, \sum_m)$ represent Gaussian parameters.

W_m represents the missing value in the suggested MiGMM model, and can be calculated from the classification rate,, where Wm summarizes the classification rate of the algorithm.

$$W_m = \frac{CR_m}{\sum_{i=1}^{M} CR_i}, \forall\, m = 1, 2, 3, \ldots, M \quad (3)$$

IV. Performance Evaluation

Three metrics have been applied have been adopted in this study of 100 images with their ground truth pictures for unifying the reference, as follows [1][13]:

Correct Detection Rate (CDR): The percentage of the pixels that are classified correctly by the algorithm as skin pixels.

False Detection Rate (FDR): The percentage of the pixels that are classified wrongly by the algorithm as non-skin pixels.

Classification Rate (CR): The number of classified skin pixels correctly by the algorithm and ground truth divided by whichever maximum of each of number of skin pixels classified by the algorithm and number of skin pixels classified by the ground truth.

International Journal of Computer Science
ISSN:2348-6600
Oddity...Probe...Reviste...
Published by SK Research Group of Companies(SKRGC)
http://www.ijcsjournal.com Volume 3, Issue 1, No 2, 2015. ISSN: 2348-6600
Reference ID: IJCS-080 PAGE NO: 456-459.

TABLE 1
COMPARISON BETWEEN MUGMM AND MIGMM TECHNIQUES.

parameter	MuGMM		MiGMM	
	Foreground (%)	Foreground and background (%)	Foreground (%)	Foreground and background (%)
CDR	99.873	99.873	99.200	99.025
FDR	0.4745	0.474	0.1624	0.0190
CR	98.825	98.825	99.200	99.025
Average	99.408	99.408	99.413	99.343

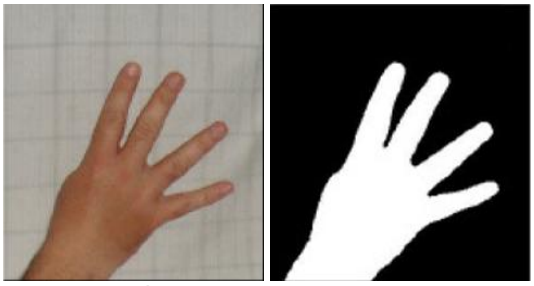
Table 1 reveals that the MiGMM outperformance on MuGMM in term of FDR and CR, however, the overall average performance of MuGMM is 99.413 % which is the better than the MiGMM.

The experimental results for each of MuGMM and MiGMM have been applied for both foreground and background training, the two applied techniques have been tested using a set of 100 images, Figure 1 and Figure 2 demonstrate the results of applying MuGMM and MiGMM techniques.

A B

A: original input image. B: skin color classification using MuGMM model.

Figure 1: MuGMM segmentation using foreground and background training [1].



A B

A: original input image. B: skin color classification using MiGMM model.

Figure 2: MiGMM skin segmentation using foreground and background models [2].

V. CONCLUSIONS

The most effective cue that can applied to construct a successful skin color segmentation modeling algorithm is the human skin color, which can be modeled to fit model distribution. Although different color models are available, however, careful selection of suitable color model plays a major role to build a robust skin color based segmentation technique. Related experiments proved that ignoring the lighting components is the proper way to ensure perfect object's segmentation under various illumination changing conditions and simplify the overall performance of the technique.

In this paper, two recently statistical parametric techniques MuGMM, and MiGMM have been discussed and explained in detail including techniques description, comparison between these techniques in term of evaluation metric, and experimental results, however, when we look at the details of the image with binary representation, encryption impression is glow in our mind and some encryption related methods like RSA [16] will be attended, however, this binary representation should be seen as whole seen and not solely and a complete image will be seen at that time.

International Journal of Computer Science
ISSN:2348-6600
Oddity...Probe...Reviste...
Published by SK Research Group of Companies(SKRGC)

http://www.ijcsjournal.com Volume 3, Issue 1, No 2, 2015. ISSN: 2348-6600
Reference ID: IJCS-080 PAGE NO: 456-459.

REFERENCES

[1] Mokhtar M.Hasan, Pramod K. Mishra, " Superior Skin Color Model using Multiple of Gaussian Mixture Model", British Journal of Science, Vol. 6, No. 1, pp. 1-14, 2012

[2] Mokhtar M. Hasan, Pramod K. Mishra, "Novel Algorithm For Skin Color Based Segmentation Using Mixture of GMMs", Signal & Image Processing: An International Journal (SIPIJ), Vol. 4(4), pp. 139-148, August 2013.

[3] Noor A. Ibraheem, Rafiqul Z. Khan, Mokhtar M. Hasan, "Comparative Study of Skin Color Based Segmentation Techniques", International Journal of Applied Information Systems (IJAIS), Foundation of Computer Science FCS, New York, USA, Vol. 5(10), August 2013.

[4] Yu-Hsiang Wang, "Tutorial: Image Segmentation", Graduate Institute of Communication Engineering National Taiwan University, Taipei, Taiwan.

[5] Wikipedia website.

[6] P.Daniel Ratna Raju, G.Neelima& K.Prasada Rao, "Image segmentation-MR Images Segmentation with A Modified Gaussian Mixture Model", International Journal of Computer Science and Information Technologies (IJCSIT), Vol. 2, No. 6 , pp. 2573-2578, 2011.

[7] Demir Gokalp, "Learning Skin Pixels in Color Images Using Gaussian Mixture".

[8] Paola Campadelli, Francesco Cusmai& Raffaella Lanzarotti, "A Color-Based Method For Face Detection". 2003

[9] Son Lam Phung, Abdesselam Bouzerdoum& Douglas Chai, "Skin segmentation using color pixel classification: analysis and comparison", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 27, No. 1, pp. 148-154, 2005.

[10] Noor A. Ibraheem, Mokhtar M. Hasan, Rafiqul Z. Khan, Pramod K. Mishra, "Understanding Color Models: A Review", ARPN Journal of Science and Technology, Vol. 2, No. 3, pp. 265- 275, 2012.

[11] Rafiqul Z. Khan, Noor A. Ibraheem, "Segmentation Algorithms for Vision Based HCI", Third Kuwait Conference on e-Services and e-Systems, December 18-20, 2012, Kuwait University, Kuwai.

[12] Noor A. Ibraheem, Rafiqul Z. Khan, "Multiple Histogram Technique for Robust Skin Color Based Segmentation", American Journal of Engineering Research (AJER), Vol. 02, No. 05, pp. 50-54, 2013.

[13] Noor A. Ibraheem, Rafiqul Z. Khan ,"Novel Segmentation Algorithm based on Mixture of Multiple Histograms", International Journal of Scientific & Engineering Research, Volume 4 (8):1074-1087, August-2013.

[14] Vezhnevets V., Sazonov V., Andreeva A 2003. A Survey on Pixel-Based Skin Color Detection Techniques.IN PROC. GraphiCon(2003), 85-92.link: http://graphics.cs.msu.ru/en/publications/text/gc2003vsa.pdf

[15] Bhattacharyya S. 2011," A Brief Survey of Color Image Preprocessing and Segmentation Techniques", Journal of Pattern Recognition Research, pp. 120-129 (2011).

[16] Mokhtar M. Hassan, Ahmed A. Abdul Redha, "Applying Quran Security and Hamming Codes For Preventing of Text Modification", Baghdad Science Journal, Vol.8(2), 2011.