International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

Automatic Face Detection by Using Skin Classifier Algorithm: Application for Attendance Management System

Naga Mahesh[1], D. Nandini[2], G. Sharanya[2], K. Akshaya[2], J. Rekha[2]

[1]Assistant Professor, [2]UG Student, [1,2]Department of Electronics and Communication Engineering
[1,2]Malla Reddy Engineering College for Women, Maisammaguda, Hyderabad, Telangana, India

ABSTRACT: we propose a skin classification method exploiting faces and bodies automatically detected in the image, to adaptively initialize individual ad hoc skin classifiers. Each classifier is initialized by a face and body couple or by a single face, if no reliable body is detected. Thus, the proposed method builds an ad hoc skin classifier for each person in the image, resulting in a classifier less dependent from changes in skin color due to tan levels, races, genders, and illumination conditions. The experimental results on a heterogeneous data set of labeled images show that our proposal outperforms the state-of-the-art methods, and that this improvement is statistically significant.

I. Introduction

Face location can be used to design a video camera system that tracks a person's face in a room. It can be used as part of an intelligent vision system or simply in video surveillance. Although the research on face segmentation has been pur-sued at a feverish pace, there are still many problems yet to be fully and convincingly solved as the level of difficulty of the problem depends highly on the complexity level of the image content and its application, In this paper, we will discuss the color analysis approach to face segmentation. The discussion includes the derivation of a universal model of human skin color, the use of appropriate color space, and the limitations of color segmentation. We then present a practical solution to the face-segmentation problem. This includes how to derive a robust skin-color reference map and how to overcome the limitations of color segmentation. In addition to face segmentation

In this paper we present an adaptive skin classification method where individual skin classifiers are initialized by a face and body couple or by a single face, if no reliable body is detected. The main contributions of this work are:

The use of both face and body detection to provide more reliable initialization for the ad-hoc individual skin classifier with respect to that initialized using face detection alone. Different strategies for selecting skin pixels from detected bodies to be used as training sets are investigated.

The design of an adaptive computational method that does not make any assumption about the presence of reliable faces/bodies in the image. Given an input image the proposed method adaptively chooses between an a priori defined skin classifier and ad-hoc skin classifiers based on face and body detection.

An extensive comparison of the proposed method with respect to the state-of-the-art on a heterogeneous dataset containing images acquired under uncontrolled lighting conditions has been carried out. The statistical significance of the improvements obtained by our proposal are assessed using a nonparametric statistical test.

II. THE PROPOSED APPROACH

The proposed skin classification method builds an ad-hoc skin classifier for each person automatically detected in the image. It exploits faces to initialize the individual ad-hoc skin classifiers, that are then reinitialized if related bodies are detected. The output of the individual classifiers are then combined to obtain the final skin mask. If the face detector does not find any face, an a-priori defined skin classifier in the state of the art is used. The flowchart of the proposed method is shown in Figure 1. There are two main blocks: the former concerning the detection of faces and bodies, the latter devoted to the skin classification. The output of the individual skin classifiers are pooled and refined to produce the final skin mask. All the parameters that are used in the processing blocks and that do not vary on the basis of the actual face and body detected, are found by optimization on a labeled dataset of training images.

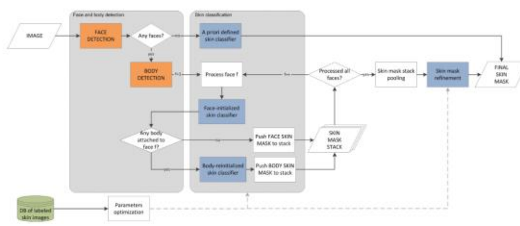


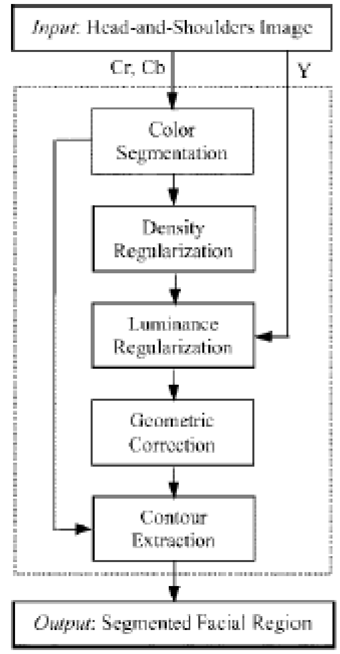
Fig. 1. Operation flowchart of our automatic adaptive skin classification method.

. Face-Segmentation Algorithm

In this section, we present our methodology to perform face segmentation. Our proposed approach is automatic in the sense that it uses an unsupervised segmentation algorithm, and hence no manual adjustment of any design parameter is needed in order to suit any particular input image. Moreover, the algorithm can be implemented in real time, and its un-derlying assumptions are minimal. In fact, the only principal assumption is that the person's face must be

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
ISSN: 2457-0362
www.ijarst.in

present in the given image, since we are locating and not detecting whether there is a face The format of the input image is to follow the YCrCb color space, based on the reason given in the previous section. The spatial sampling frequency ratio of Y, Cr, and Cb is The algorithm consists of five operating stages, as outlined in Fig. 5. It begins by employing a low-level process like color segmentation in the first stage, then uses higher level opera-tions that involve some heuristic knowledge about the local connectivity of the skin-color pixels in the later stages. Thus, each stage makes full use of the result yielded by its preceding stage in order to refine the output result. Consequently, all the stages must be carried out progressively according to the given sequence. A detailed description of each stage is presented below. This input image is shown in Fig.



Color Analysis

The use of color information has been introduced to the face-locating problem in recent years, and it has gained increasing attention since then. Some recent publications that have reported this study include The color information is typically used for region rather than edge segmentation. We classify the region segmentation into two general approaches, as illustrated in Fig. 5.1. One approach is to employ color as a feature for partitioning an image into a set of homogeneous regions The other approach, however, makes use of color as a feature for identifying a specific object in an image. In this case, the skin color can be used to identify the human face. This is feasible because human faces have a

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

special color distribution that differs significantly (although not entirely) from those of the background objects. Hence this approach requires a color map that
models the skin-color distribution characteristics.

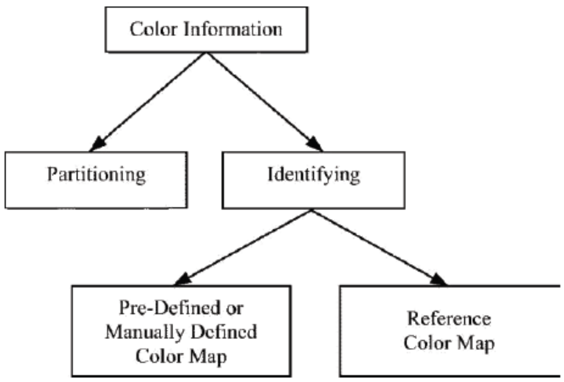


fig. 5.1. The use of color information for region segmentation.

Fig5. 4. *Foreman* and *Carphone* images, and their color segmentation results, obtained by using the same predefined skin-color map.

A.**Color Space**

An image can be presented in a number of different colorspace models · *RGB:*

This stands for the three primary colors: red, green, and blue. It is a hardwareoriented model and is well known for its color-monitor display purpose.

· *HSV:*

An acronym for hue-saturation-value. *Hue* is a color attribute that describes a pure color, while *saturation* defines the relative purity or the amount of white light mixed with a *hue; value* refers to the brightness of the image. This model is commonly used for image analysis.

· *YCrCb:*

This is yet another hardware-oriented model. However, unlike the RGB space, here the luminance is separated from the

IJARST
International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

chrominance data. The Y value repre-sents the luminance (or brightness) component, while the Cr and Cb values, also known asthe color difference signals, represent the chrominance component of the image.

The skin color segmentation in applied to YCbCr color space. So first of all RGB color space is converted to YCbCr color space. Y represents the luminance and Cb and Cr represents chrominance. The RGB color space is converted to YCbCr color space using the following equation:

$$Y = 0.299R + 0.587G + 0.114\,B$$
$$Cb = (B - Y) * 0.564 + 128$$
$$Cr = (R - Y) * 0.713 + 128$$

………(1)

The skin color segmentation is used to classify the pixel as skin pixel or non-skin pixel. As or hand is connected component made of skin pixels we will get the hand after skin color segmentation. Steps for skin color segmentation:

1. The first step in skin color segmentation to specify the range for the skin pixels in YCbCr color space.

$$[R_{Cb}, R_{Cb}'] = [77, 127] \quad \&$$
$$[R_{Cr}, R_{Cr}'] = [133, 173]$$

………….(2)

2. Find the pixels (p) that are in the range defined above:is lower and upper bound for Cb component.

$$R_{Cb} \leq Pixel\ value(Cb(i,j)) \leq R_{Cb}'$$
$$R_{Cr} \leq Pixel\ value(Cr(i,j)) \leq R_{Cr}'$$

……..(3)

Limitations of Color Segmentation

In addition to poor color contrast, there are other limitations of color segmentation when an input image is taken in some particular lighting conditions. The color process will encounter some difficulty when the input imag

 a ªbright spotº on the subject's face due to reflection of intense lighting;

 a dark shadow on the face as a result of the use of strong directional lighting that has partially blackened the facial region;

 been captured with the use of color filters.

Note that these types of images (particularly in cases 1 and 2) are posing great technical challenges not only to the color segmentation approach but also to a wide range of other face- segmentation approaches, especially those that utilize edge image, intensity image, or facial feature-points extraction.

. Stage Two-Density Regularization

This stage considers the bitmap produced by the previous stage to contain the facial region that is corrupted by noise. The noise may appear as small holes on the facial region due to undetected facial features such as eyes and mouth, or it may also appear as objects with skin-color appearance in the background scene. Therefore, this stage

performs simple morphological operations such as *dilation* to fill in any small hole in the facial area and *erosion* to remove any small object in the background area. The intention is not necessarily to remove the noise entirely but to reduce its amount and size To distinguish between these two areas, we first need to identify regions of the bitmap that have higher probability of being the facial region. The probability measure that we used is derived from our observation that the facial color is very uniform, and therefore the skin-color pixels belonging to the facial region will appear in a large cluster, while the skin-color pixels belonging to the background may appear as large clusters or small isolated objects. Thus, we study the density distribution of the skin-color pixels detected in stage one. An array of density values, called density map , is computed as

$$D(x,y) = \sum_{i=0}^{3}\sum_{j=0}^{3} O_1(4x+i, 4y+j)$$

2

Fig.5. 8.Bitmap produced by stage two.

Stage Three—Luminance Regularization

We have found that in a typical videophone image, the brightness is nonuniform throughout the facial region, while the background region tends to have a more even distribution of brightness. Hence, based on this characteristic, background region that was previously detected due to its skin-color appearance can be further eliminated The bit map three stages, donter bit map O(x,y) derived in as

$$\sigma(x,y) = \sqrt{E[W^2] - (E[W])^2}.$$

$$O_3(x,y) = \begin{cases} 1, & \text{if } O_2(x,y) = 1 \quad \text{and} \quad \sigma(x,y) \geq 2 \\ 0, & \text{otherwise} \end{cases}$$

International Journal For Advanced Research
In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362
IJARST

Fig.5. 9. Bitmap produced by stage three.

Stage four Geometric Correction

We performed a horizontal and vertical scanning process to identify the presence of any odd structure in the previously obtained bitmap, , and subsequently removed it. This is to ensure that a correct geometric shape of the facial region is obtained. However, prior to the scanning process, we will attempt to further remove any more noise by using a technique O3 (x,y) detected pixel if there are more than three other pixels, in its local 3 3 neighborhood, with the same value. At the same time, a pixel in with a value of zero will be reconverted to a value of one (i.e., as a potential pixel of the facial region) if it is surrounded by more than five pixels, in its local 3 3 neighborhood, with a value of one. These simple procedures will ensure that noise appearing on the facial region is filled in and that isolated noise objects on the background are removed. We then commence the horizontal scanning process on the ªfilteredº bitmap. We search for any short continuous run of pixels that are assigned with the value of one. For a CIF-size image, the threshold for a group of connected pixels to

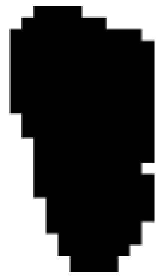


Fig. 5.10. Bitmap produced by stage four.

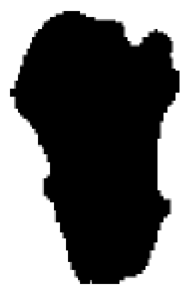


Fig. 5.11. Bitmap produced by stage five.

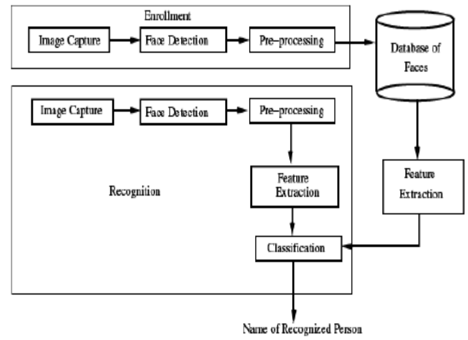
The proposed skin-color reference map is intended to work on a wide range of skin color, including that of people of European, Asian, and African decent. Therefore, to show that it works on subject with skin color other than white (as is the case with the Miss America image), we have used the same map to perform the color-segmentation process on subjects with black

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

and yellow skin color. The results obtained were very good, as can be seen in Fig. 15. The skin-color pixels were correctly identified, in both input images, with only a small amount of noise appearing, as expected, in the facial regions and background scenes, which can be removed by the remaining stages of the algorithm.

Fig. 5.12. Results produced by the color-segmentation process in stage one and the final output of the face segmentation algorithm.

We observed that this algorithm gives better results in different lighting conditions and we combined multiple haar classifiers to achieve a better detection rates up to an angle of 30 degrees.



5.13 Figure: system architecture

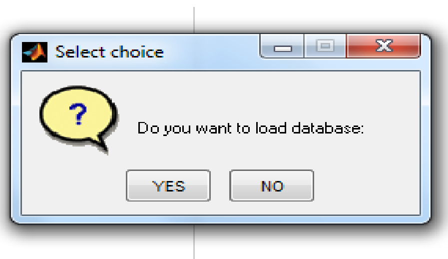
5.5 Database Development

As we chose biometric based system enrollment of every individual is required. This database development phase consists of image capture of every individual and extracting the bio-metric feature, in our case it is face, and later it is enhanced using preprocessing techniques and stored in the database. In our project we have taken the images of individuals in different angles, different expressions and also in different lighting conditions. A database of 13 individuals images of each has been collected for this project. Figure 2 shows few extracted and pre-processed faces stored in the database.

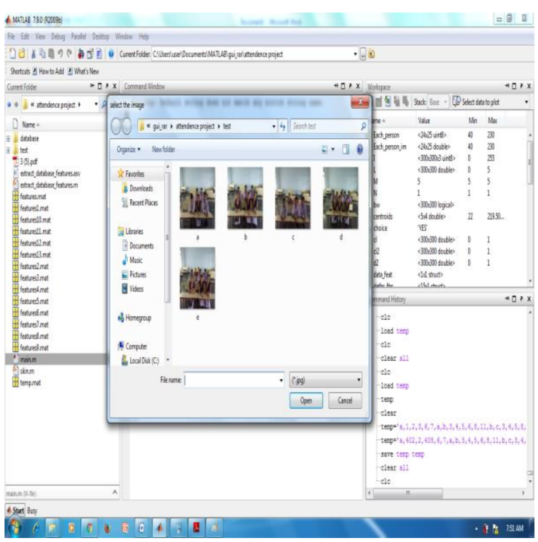
5.6 Feature Extraction

The performance of a Face Recognition system also depends upon the feature extraction and their classification to get the accurate results. Feature extraction is achieved using feature based techniques or holistic techniques. In some holistic techniques we can make use of dimensionality reduction before classification. We compared the results of different holistic approaches usedFor feature extraction and classification in real time scenario Normally the textures may be random but with the consistent properties. Such Textures can be described by their statistical properties. Moment of intensity plays a major role in describing the Texture in a region The three colors moments are defined with figures.

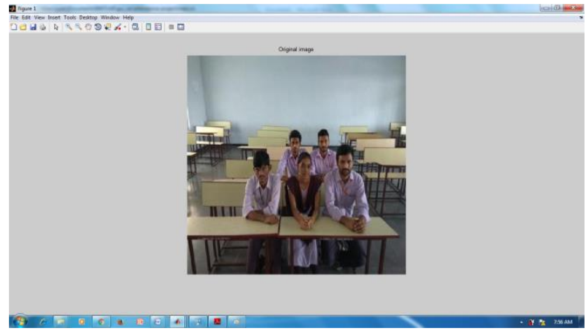
Load the database



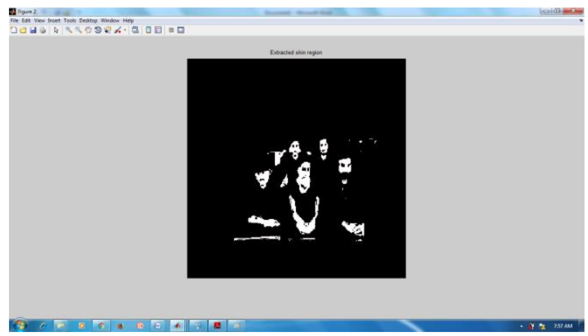
Select the input

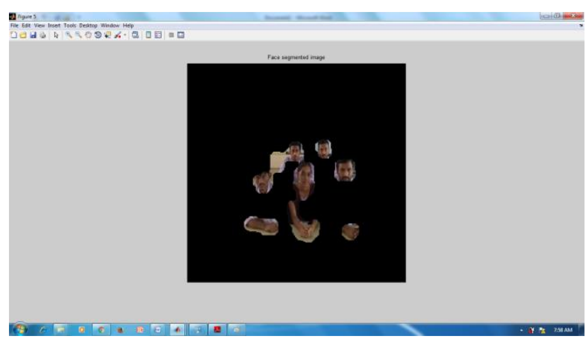


Input image



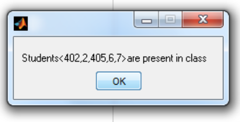
Extracted skin region





Output: Face segmented image

IJARST
International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362



CONCLUSION

We proposed a methodology to perform face recognition under the combined effects of non-uniform blur, illumination, and pose. We showed that the set of all images obtained by non-uniformly blurring a given image using the TSF model is a convex set given by the convex hull of warped versions of the image. Capitalizing on this result, we initially proposed adaptive skin classification . We then showed that the set of all images obtained from a given image by We then extended the capability of MOBIL to handle even non-frontal faces by transforming the gallery to a new pose. We established the superiority of this method called MOBILAP over contemporary techniques. Extensive experiments were given on synthetic as well as real face data. The limitation of our approach is that significant occlusions and large changes in facial expressions cannot be handled.

REFERENCES

[1] A. F. Abate, M. Nappi, D. Riccio, and G. Sabatino, "2D and 3D face recognition: A survey," Pattern Recog. Lett., vol. 28, no. 14, pp. 1885– 1906, Oct. 2007.

[2] T. Ahonen, A. Hadid, and M. Pietikainen, "Face recognition with local binary patterns," in Proc. 8th ECCV, N. Sebe, M. S. Lew, and T. S. Huang, Eds., 2004, pp. 469–481.

[3] T. Ahonen, A. Hadid, and M. Pietikäinen, "Face description with local binarypatterns: Application to face recognition," IEEE Trans. Pattern Anal. Mach. Intell., vol. 28, no. 12, pp. 2037–2041, Dec. 2006.

[4] B. Becker and E. Ortiz, "Evaluation of face recognition techniques for application to Facebook," in Proc. IEEE Int. Conf. Autom. Face Gesture Recog., 2008, pp. 1–6.

[5] P. N. Belhumeur, D. W. Jacobs, D. J. Kriegman, and N. Kumar, "Localizing parts of faces using a consensus of exemplars," in Proc. IEEE Conf. CVPR, 2011, pp. 545–552.

[6] J. R. Beveridge, P. J. Phillips, G. H. Givens, B. A. Draper, M. N. Teli, and D. S. Bolme, "When high-quality face images match poorly," in Proc. IEEE Int. Conf. Autom. Face Gesture Recog. Workshops, 2011, pp. 572–578.

[7] V. Blanz and T. Vetter, "Face recognition based on fitting a 3D morphable model," IEEE Trans. Pattern Anal. Mach.

Intell., vol. 25, no. 9, pp. 1063– 1074, Sep. 2003.