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A FUTURE APPROACH FOR HUMAN FACE IDENTIFICATION

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Abstract

Human Face Identification is an Information technology that identifies the positions of human faces in bits of images. It recognizes Human facial properties and eliminates everything else, such as animals, cars and bodies. It plays an important role in video surveillance, smart cards, protection, Face Databases, Access control and Human Computer Identification.
Human face is one of the most significant features to detect persons in an image. As sufficient luminous information is not available in the existing approach, we propose a new method to identify various colors of human face. The proposed methodology identifies how to reveal human face from the background image.
Keywords: Face recognition, skin detection, color segmentation
.

1. Introduction

In recent years, face identification has induced much attention and its analysis has widely expanded not only by engineers but also by neuroscientists. System vision idea and automatic access supervision system together has many implied functions. Particularly, face identification is the main segment of face recognition. Face identification is not direct forward because it has lots of deviation in image appearance, such as pose deviation (front, non-front), closure, image position, highlighting condition and facial assertion.
Spanning infinite fields and development are the imperative investigation difficulty of Face Identification. Additional, keeping infinite practical applications such as bankcard establishment, access control, Mug shots check out, security observing, and surveillance system, is a central human behavior which is fundamental for impressive communications and cooperation among people.

Face identification ideology can use different approaches, including:
i) The use of facial component revealers ((i.e.) eye, nose, mouth): The main flaw of this method is the number of component revealers needed. ii) The use of skin color illumination: The main flaw of this method is the consciousness of plausible skin color to atmosphere lighting condition. iii) The use of analytical approaches: For example constructing analytical model of facial fields. [1] The methods discussed above, can be exactly applied to colored or grayscale images. This paper targeted to establish a face identification ideology depends on an analytical approach developed by Schneidermann-Kanade [2].
An approved method of grouping faces was first proposed in [2]. The author proposed corralling facial profiles as curves, finding their mean, and then corralling other profiles by their diversions from the mean. Then this division is multi-modal, i.e. this will arises in a vector of absolute dimensions that will be correlated with other vectors in the database. Expedition has promoted to the point that face identification ideology were being determined in real-world environment [4]. Effective improvement of algorithms, the possibility of large database of facial images, and a method for estimating the act of face identification algorithms are the factors of fast improvement of face identification. From the observation, face identification problem can be contrived by given captured or video images of a scene, analyzing or certify one or more persons in the scene by contrasting with faces stored in a database.
During person identification contrasting to Face identification, it starts with the recognition of face impression in littered scenes, continued by ordering the face images to

report for mathematical and lighting modification, perhaps using information about the location and display of facial landmarks, detects the faces using suitable categorization algorithms, and verify the results using model-based arrangements and observation [6]. This paper is classified as follows. Similar works in face recognition are discussed in Section 2. In Section 3, the proposed methodology is described, which is followed by developmental results in Section 4. Section 5 concludes the paper.

2. Previous Work

2.1 AdaBoost

A Strong classifier can be fabricated as a linear mixture of weighted transparent weak classifier by using a technique called Adaptive boost.

$$F(x) = \propto_1 p_1 + \propto_2 p_2 + \propto_3 p_3 + \cdots$$

It is used to search for a few good classifiers that adaptively fabricate a final strong classifier by taking each selected weak classifiers failures into account which is used for both choosing a small set of features and training a strong classifier. This technique had three steps, the first step is weights are uniformly distributed using AdaBoost, and secondly, lowest weighted error classifiers are selected and thirdly, misclassified weights are increased and at the end, all iteration of week classifiers is mixed carefully.

$$f_{strong}(x) = \begin{cases} 1 & \propto_1 f_1(x) + \cdots + \propto_n f_n(x) \geq \frac{1}{2}(\propto_1 + \cdots + \propto_n) \\ 0 & otherwise \end{cases}$$

2.2 Eigen faces for recognition:

Eigen faces is an approach which contains a set of eigenvectors that are used in computer vision problem of human face recognition. This was the first successful method used for facial identification which was determined from the covariance matrix that contains hazard allotment of heading space with more dimension. There are four steps to implement this technique. The first step, processing the image database (set of images with tag) and secondly, a new image y is given as input and coefficients n is determined,

$$y \rightarrow (k_1, k_{2,\ldots,} k_n)$$

And thirdly, it will detect and highlight the face, if y is a face

$$\|y - (\bar{y} + k_1 v_1 + k_2 v_2 + \cdots + k_n v_n)\| < threshold$$

2.3. Bayesian Face Recognition

The matching technique over Bayesian Face Recognition and standard Eulidean nearest-neighbour Eigenfaces comparable was established using results from DARPA in 1996. FERET, A face identification contest, in which Bayesian matching algorithm was founded as best aerialist in face detection. It extant a probabilistic similarity measure based on the Bayesian belief that the image intensity differences, expressed by $\Delta = x_1 - y_2$,are the characteristic those typical variations in appearance of an individual. Similar measure are denoted in terms of the probability

$$S(x_1, x_2) = p(\Delta \epsilon \Omega_x) = p(\Omega_x|\Delta)$$

Where $P(\Omega_I|\Delta)$ the bayes rule's posterior probability, determination of the likelihoods $p(\Delta|\Omega_x)$ and $p(\Delta|\Omega_y)$.where Ω_x is the intra personal and Ω_y is the extra personal.

$$\Omega_x \equiv \{\Delta = k_i - k_j : L(k_i) = L(k_j)\}$$

$$\Omega_y \equiv \{\Delta = k_i - k_j : L(k_i) \neq L(k_j)\}$$

$$s = \frac{p(\Delta|\Omega_x)p(\Omega_x)}{p(\Delta|\Omega_x)p(\Omega_x) + p(\Delta|\Omega_y)p(\Omega_y)}$$

Bayesian approach for face recognition is the first example of a non-Euclidean similarity measure used in face recognition.

3. Proposed Methodology

3.1. Color Segmentation

In colored image, the very famous and effective approach for face identification is Revelation of skin color. Generally, Skin color region in an image can be identified by many approaches. Suppose if the given color image is in the RGB pattern, Color components are normally used by these methods in the color space, such as the HSV or YIQ pattern because RGB components are detected based on the lighting conditions, Face identification fails if lighting conditions modifies. Among many other color spaces, our project uses YCbCr components where the computation time is saved compared to other methods. In this YCbCr color space; Y component holds the luminance information, and Cb and Cr holds chrominance information of red and blue. Similarly, this luminance information can be easily de-embedded. Following formula is used to convert the component from RGB to YCbCr:

$$Y = 0.113B + 0.586G + 0.298R$$
$$Cb = 0.501B - 0.331G - 0.168R$$
$$Cr = - 0.082B - 0.418G + 0.501R$$

In this skin color recognition process, each and every pixel will be classified as skin or non-skin based on its own color components. Cb and Cr components are used to clearly indicate whether the particular pixel is a part of skin or not. The framework of skin color recognition will be concluded depend on the Cb and Cr component's mean and predictable difference (SD). Among, Cb and Cr components, there was an equivalence in whole given image, which is used to reveal the comparison between faces and non faces in the YCbCr space. From the figures, it is apparent that applying minimum and maximum threshold values for both Cb and Cr components are applied to distinguish the background and faces from the image. Their histogram distribution is shown in the figure below:

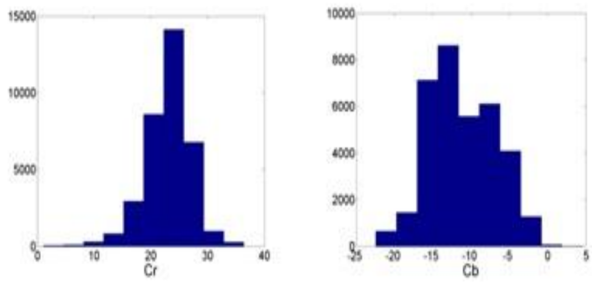


Figure 1: The histogram distribution of Cr and Cb component

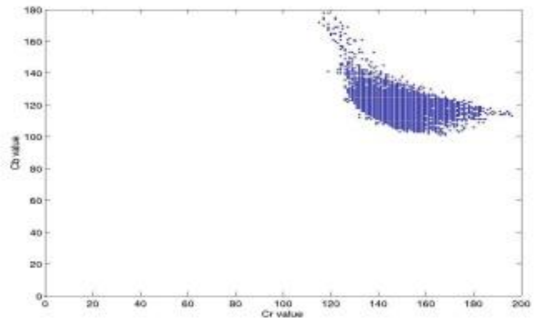


Figure 2: Skin pixels equivalence between Cr and Cb values

The thresholds are chosen based on the histograms in figure and investigate with data are as following:

$$141<Cr<166$$
$$106<Cb<136$$

Restricting these thresholds, the probability will be enlarged by denying the background and also accepting the pixels that are actually part of the skin. All the trained images are applied with color segmentation and its conclusion is shown in below figure. Even though, their colors fall into the skin color region because few of the non-skin entity will be extracted in the below resultant.

Figure 3: Skin objects are extracted from the background

3.2 Image Segmentation

The next step is image segmentation which will classify the image splashes in the colour drained binary image into separate regions. This process consists of three steps. The starting step is to fill up all the black detached gap dots in the image and also remove all the white detached regions that are smaller when compared to the minimum face area in given image input. Conservatively, set the threshold (170 pixels) value. The drained image followed by initial erosion only leaves the white regions with possible extent as demonstrated in the below figure:

Figure 4: Erosion initial image with filtered image

In next step, it will allocate few merged regions into separate faces, and then the *Roberts Cross Edge detection algorithm* is used.

3.3 The *Roberts Cross Edge algorithm*

This algorithm *is* easy, can compute quickly, and it performs 2-D spatial gradient measurement over the given input image. This algorithm will highlight the regions which contain high spatial frequency that often correspond to edges. Mostly, we give Grayscale image as the input to the operator. Pixel values established at each point in the output is determined as the exact value of the spatial gradient of the given image at that pointing.

There was a pair of 2x2 spiral kernels for the operator as shown in below figure. Each Kernel is similar to the other one which is rotated around 90˚.

+1	0
0	-1

Gx

0	+1
-1	0

Gy

Figure 5: Roberts cross convolution kernels

The edges running at 45˚ to the pixel grid are responded through the designed kernels. These kernels can be applied to the input image separately, which will produce different measurements of the gradient component in each orientation (call these Vx and Vy). These orientation are grouped together to establish the exact magnitude and orientation of that gradient at each point. The gradient magnitude is given by:

$$|V| = \sqrt{Vx^2 + Vy^2}$$

$$|G| = \sqrt{Gx^2 + Gy^2}$$

Similarly, a magnitude is computed using:

$$|V| = |Vx| + |Vy|$$

The pseudo-complex operator which contains two gradient components that is equally computed and included into the input image as a single pass are show in figure 6.

C1	C2
C3	C4

Figure 6: Uses Pseudo-complex kernels for quickly computing the exact gradient magnitude.

Kernel is used to exact the magnitude which is mentioned as:

$$|V| = |C1 - C4| + |C2 - C3|$$

The spotted region is then converted into black lines and eroded to join crossly divided pixels.

Figure 7: Robert cross detector detects the Edges

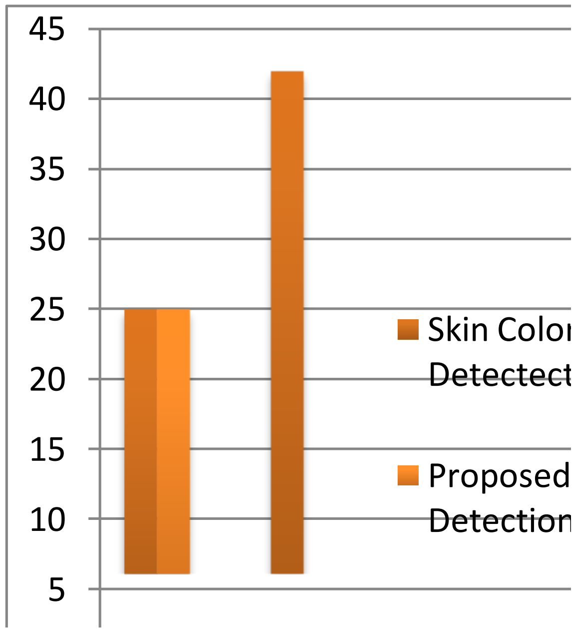
1.1 3.4. Edge Extraction Template Face

We have been addressed to various methods of face template. Analyzing what will categories the face lies within its feature, we have been planned to convert all the greyscale images to black and white images, and edge separation method is used to separate the main features and they are grouped to form a face template. In the comparison of images method, comparison is the part of the dividing the images. There are different template techniques such as edge recognition matching, boundary recognition, thresholding, crewing, and texture matching. In the proposed method, we used edge recognition, template matching and also used Robert cross edge detector which is used to detect the edges. The resultant image is the trained image which is used in the template matching, that can be easily used to find the location of human parts (like mouth, eyes and nose etc...).From that result, we can able to detect the faces and remove the non-faces. The below face was extracted from the sample of 25 faces which are taken from the enlighten set.

Figure 8: Template Matching Image

4. Experimental Results:

The examinations of the face identification system were performed on Window 7 (OS), and along with 2.4 GHz processor with 3 GB of RAM is used. MATLAB version R2012b is used for implementation. RGPV database is created by us which will store 25 images. Those stored images contain various faces with differ in colours, order, size and expression and positions etc...In this method, we gave the input image as RGB image that will be converted into YCbCr images. In which we can able to apply the threshold value and those threshold image is then converted into black and white image. Assume that the skin region value is 1(white) and non skin region value as 0(black). Skin color identifier is used, that will identify the next skin region and remove all the non skin pixels from the image. But from this method we also identify some non faces and then applied the Robert cross edge detector algorithm and at last template matching is used which will produce the face detection as output result. This template matching method will detect the faces more accurately as shown in figure.



Detection	*Skin Color*	*Proposed Method*
Faces	*25*	*25*
Non Faces	*42*	*1*

Figure 9: Performance of the proposed method

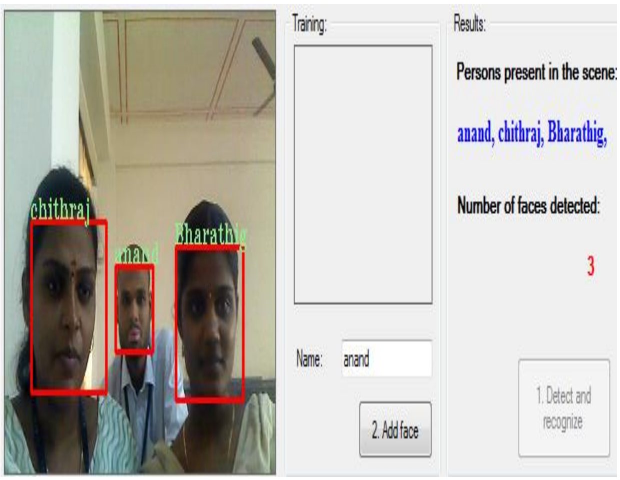


Fig 10: Final Detected result of an image

5. Conclusions

This paper describes how the face is identified under various conditions using different algorithms. Initially, our identification algorithm takes the colour image and use skin illumination compensation model that will convert the from RGB image to YCbCr image which is easy to detect the appropriate skin regions. Then all the recognized skin regions are converted to binary arrangement with corresponding signatures. From these results, we can state that our technique outperforms all other published and popular techniques.

References

[1] Iwan Setyawan, Yohan Wibowo and K.Timotius "Human Face Detection System Based on Schneiderman-Kanade Method" in: Proceedings. Of IEEE International Conference on Telecommunication Systems, Services and Applications 2011.

[2] H.Schneiderman and T.Kanade, "A Statistical Method for 3D Object Detection applied to Faces and Cars", Proc. Conf. Computer Vision and Pattern Recognition, Vol. 1, pp.746-- - 751, 2000.

[3] R.C. Gonzales and R.E. Woods, "Digital Image Processing", 3rd ed., USA: Prentice-Hall, 2009.

[4] P. Viola, M. Jones, Robust real time object detection, in: Proc. IEEE ICCV Workshop on Statistical and Computational Theories of Vision, 2001.

[5] A. Lanitis, C. J. Taylor, and T.F. Cootes, "An automatic face identification system using flexible appearance models", Image and Vision Computing, vol.13, no.5, pp.393-401, 1995.

[6] P. Shih, C. Liu, Face detection using discriminating feature analysis and support vector machine in video, in: Proc. 17th Intl. Conf. Pattern Recognition, 2004.

[7] H. Schneiderman, A statistical approach to 3D object detection applied to faces and cars, Ph.D. Dissertation, R.I., Carnegie Mellon University, 2000.

[8] M. turk and A. Pentland, "Eigenfaces for recognition," J. of Cognitive Neuroscience, vol.3, no.1, pp. 71-81, 1991.

[9] T. Jebara, K. Russell, A. Pentland, Mixtures of eigenfeatures for real-time structure from texture, in: Proc. IEEE Intl. Conf. Computer Vision, Mumbai, India, pp.128-135.

[10] S. M. S. Islam, M. Bennamoun and R. Davies, "Fast and Fully Automatic Ear Detection Using Cascaded AdaBoost" Proc. of IEEE Workshop on Application of Computers, 2008.

[11] K. Joshi, and N. Chauhan, "An Ear Detection and Support Vector Machine based Approach for Human Ear Detection and Verification", Int. Conf. Intelligent Systems and Data Processing (ICISD-2011), G.H. Patel College of Engineering and Technology, Gujarat, India, 24-25 January, 2011.

[12] H. Chen and B. Bhanu, "Human Ear Detection from 3D Side Face Range Images". 3D Imaging for Safety and Security, vol.35, Springer-2007, pp.133-155.

[13] K.Joshi, and N. Chauhan, "A Template Matching and Support Vector Machine based Approach for Human Ear Detection and Verification", Int. Conf. Information, Signals, and Communictions(ICISC-2011), A. D. Patel institute of Technology, Gujarat, India, 5-6 February, 2011.

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