Review of Face Detection based on Color Image and Binary Image

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ABSTRACT
In today's digital world the major issue is authentication and identification. In authentication and identification the significant role is face detection. In real time application, face detection has become a challenging and interesting area. In last few year number of algorithm have been developed for face detection. In this paper, for different color model like RGB, YCbCr, HSI,CIELAB, are explained and different face detect method for all these color models are reviewed. In binary image method of face detection included LBP, PCA. This review have investigates all these methods with parameters like range, advantage and disadvantage.

Keywords
Face, Skin Color, Segmentation, LBP.

1. INTRODUCTION
The main characteristic of human being is biometric, which can be used to recognize an individual's identity. Application or biometric likes,[16]

a) Facial Recognition

b) Iris-scan

c) Skin Color

From digital image to determine the location and sizes of human faces, face detection technique is used. It only detects faces and ignores the other object from an image. If anyone want to learn the face detection in detail then they have to go through face localization technique. The task of face localization is to find the location and sizes of the known faces from the images[18].

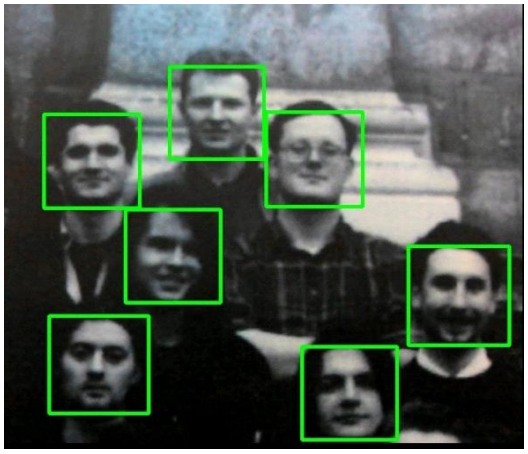

Figure1: Face Detection Demo

Face detection main goal is to detect/identify the scale and location of faces from the image.

In images the process of face detection are more complex, because of changes present in human faces like expression, skin color, glasses presence, lighting condition, image resolution and etc.

In given image, face detection method discovers the possible faces at different location with different sizes.

If the face is shown in the mirror the there will be a certain distinguishable landmarks. The distinguishable landmarks are the peaks and valleys which makes the different in facial features. In software its defines the landmarks as a nodal point as soon in figure 2 [18].

In human faces there are "80 nodal points". And some of them are measured by the software:

1. Distance between the eyes
2. Width of the nose
3. Depth of the eye socket
4. Cheekbone
5. Jaw line

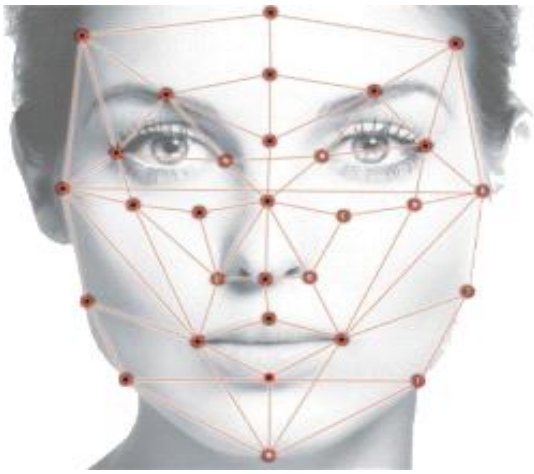

Figure2: Nodal Point on Face

For detecting the human faces there are many technique available. For face detection, all research paper have some methods. All the methods are described in the next session.Biometric face recognition, otherwise known as Automatic Face Recognition (AFR), is a particularly attractive biometric approach, since it focuses on the same identifier that humans use primarily to distinguish one person from another: their "faces". One of its main goals is the understanding of the complex human visual system and the knowledge of how humans represent faces in order to discriminate different identities with high accuracy. The face recognition problem can be divided into two main stages: face verification (or authentication), and face identification (or recognition).

2. LITERATURE REVIEW

Study on the various color models for face detection i.e. RGB, HSV, YCbCr and CIELAB are included. Comparison between RGB,HSV, and YCbCr & CIELAB is done. RGB: To detect the pixels of skin color in RGB, a normalized color histogram is used. It is light sensitive. HSV:HSV means Hue Saturation Value. H-color of red, blue and yellow range of 0 to 360. S-purity of color and takes value from 0 to 100%.V-brightness of color. H and S will provide the information about the skin color. YCbCr: Luminance(Y channel) and chrominance (Cb and Cr channels).To improve RGB color model, YCbCr color model is used. CIELAB: CIE-international commission on illumination. Uniform color scale is used in CIELAB, because it is easy to use and everyone can use easily. After comparing all the color model, YCbCr is better than other because it gives better output in lightening condition is done [1]

For detecting the face in the controlled background combination of three color model is done. Color model like RGB, YCbCr, and HSI.Original images is combined with three methods i.e. RGB, YCbCr and HIS and form a Binary image after dilation and erosion which represents skin region is done [2]

Author has developed a method to detect and track human faces. Skin color classification is used to detect faces in the first frame. These detected face are tracked over the frames by using position of the face in frame as marker. Skin color analysis method is powerful which can be used to detect/track multiple faces. An algorithm has been developed to detect and track human face(s) which starts with human skin color modeling. Skin color is found to be a powerful feature for separating potential face candidates. It is also useful for detecting multiple human faces in an image. It is orientation independent is done [3]

There are the method for face detection is fast. First extract skin color region of image and process them with morphologic processing and roughly filtering method. And also there was the use of method to detect face by geometric feature of eyes. Two methods:

i) Morphologic Processing: From image it is very difficult to confirm face because of mass of discrete point. Because of some small holes in the region of eyes, nose and mouse etc.

ii) Roughly Filtering: Every face has certain size. If height and width of one region is less than 19 pixel then that region is removed.

iii) Verify eyes: We assume that number m is possible eyes blocks. If m=2 then we assume there are two pair of concentric circles. If the two ratios are larger than threshold 0.8 that two blocks are eyes. If we find eyes in one region then we verify that region is face is done [4]

In the given color group photo the problem is used to detect the face. For face detection in color images with multiple faces and skin tone regions an improved segmentation algorithm is proposed. For the detection of human faces RGB-HSV-YCbCr is used. Number of detected faces and non-detected faces are counted is done [5]

FDC= no. of false detections

---*100

Total no of detections

DSC= no of correctly detected faces

---*100

Total no of faces

One image is taken online or offline and on that images the below steps are followed. From that image the featured are extracted and because of the increasing of identity theft the below steps are followed is done [6]

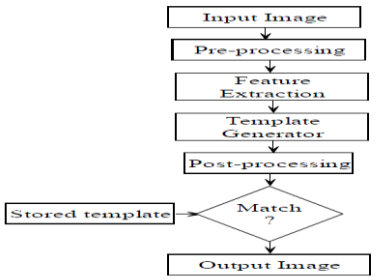

Figure 3.1 Block diagram of face detection[7]

Using different color space comparison is done. Using

The automatic Grab Cut technique it perform the image Segmentation a color quantization clustering techniqueIs used by Orchard and Bouman foreground and Back-ground image is separated using image segmentation. Automatic Grab Cut is applied with RGB, HSV, CMY,XYZ, and YUV color spaces.RGB stand for:-red, green,blue Every individual device varies with RGB.HSV stand For:-Hue, Saturation, Value HSV is a color model that Describes colors (hue or tint) in terms of their shade

(Saturation or amount of gray) and their brightness

(Value or luminance).CMY stand Cyan, magenta, and

Yellow XYZ is primary color and stand red, green, blue

YUV stand Luminance (Y), blue–luminance (U), red–luminance (V) is done [7]

Face representation, feature extraction and classification is the three main part.

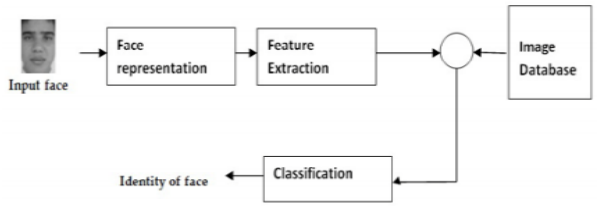

Figure 3.2 Principle of an identification process with face recognition[12]

Local Binary patterns:-

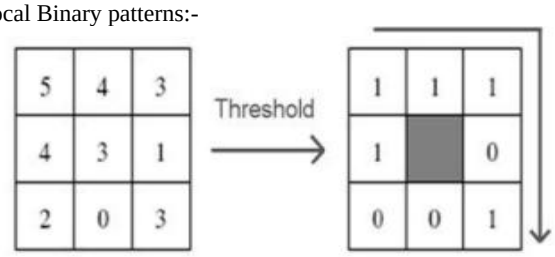

Figure 3.3 The Original Operator[12]

The center pixel is considered as a threshold value and if the other pixel value is greater than threshold value than 1 otherwise 0 is done [8]

LBP (local binary patterns) method can used.LBP describe to texture description. Operator assigns label to every pixel of the image segment 3*3 neighbor pixels each with respect to center pixel value and the resultant is considered as a binary value. To deal with textures on different scale values, Operator was compared with different sizes of neighborhood, Defining local pixel as set of sampling points evenly distributed around the circle centered to be labeled allows any radius or any sampling point is done [9]

The Challenging problem is to recognize the face by the computer. From the face, the most characteristics of human faces are the eye, nose and mouth region is extracted. The combination of Local Binary Pattern(LBP) and Principal Component Analysis (PCA) is presented. In LBP, the texture descriptor is used for the face images and to normalize the images. In PCA, dimension reduction for feature vector is used is done [10]

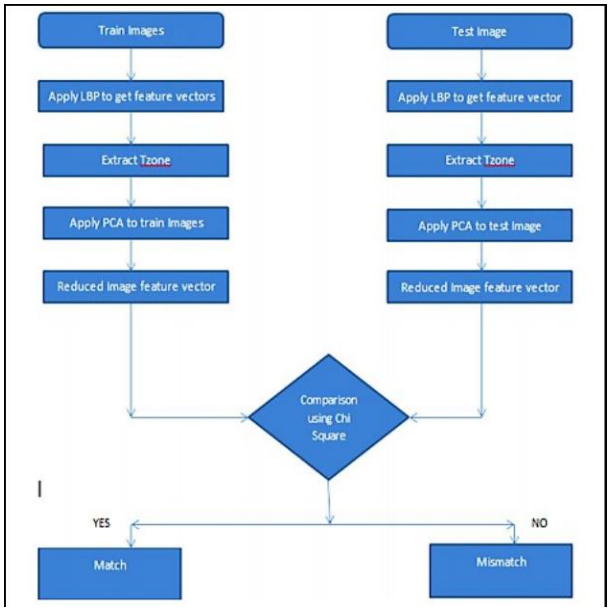

Figure 3.4 Design Overview[13]

The most important featured of human being is face. Every human being have a different faces and that is used for the identification of the human being. To detect the face of human being is not one of the problem but to identify the expression of the faces is difficult. Face expression recognition id used in many application like authentication, security issues, surveillance. Local Binary Pattern(LBP) is used for recognition of the faces. For face recognitions, LBP is a popular technique.

LBP:-

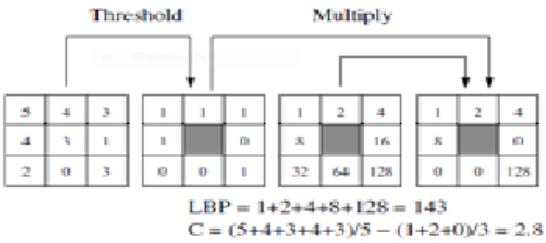

Figure 3.5 Working of LBP operator[10]

In this the threshold value is taken and there is one structuring element and that structuring is multiplied by the binary value and the result is taken out. In LBP the whole image is divided into

Equal sized blocks. Then local binary pattern is computed for each pixel in all blocks by comparing the centre pixel with neighbour pixels.

Improved LBP:-

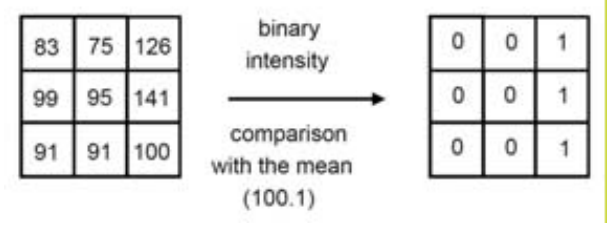

Figure 3.6 An example of ILBP operator[10]

The image is taken and on that image the binary conversion is done and compared that binary image with 1001 is done [11]

In this paper eye detection method is used. There are three steps:

extraction of binary edge images (BEIs)from the grayscale face image based on multi-resolution wavelet transform, extraction of eye regions and segments from BEIs and Eye localization based on light dots and intensity information. Eye are the most primary and stable feature in human face. Eye detection is a very important and challenging research topic of an automatic human face recognition system. Input image then perform coarse extraction of the face region. Then check scale normalization and BEI extraction. Then check face region refinement and eye analog segment extraction. Then check eye region extraction and light dot detection. Light dot detection can be match then detect to the eye otherwise check to eye segment extraction and grayscale eye region segmentation then detect eye is done [12]

Biometrics has been in trend in case of security purpose and has been well applied for face detection and face verification purpose. Certain methods and logarithms has been applied for successful and reliable authentication and verification. Such as local binary pattern (LBP). Which is followed by security of network and convenience to user. Illumination normalization also leads to two approaches. Base on 2d image and 3d object. Into which process done with the threshold value which is being process with center pixel.

LBP:

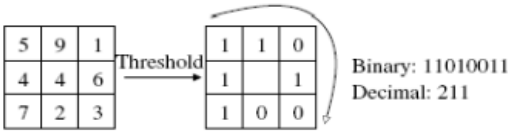

Figure 3.7 The LBP operator: the binary result and the decimal result[13]

Simplified LBP as a Preprocessing Method: Same as LBP. Works on pixel values based on its threshold value. Value is achieved based on its surrounding pixels.

Verification Based On Likelihood Ratio -using likelihood ratio method works on all pixels of image and find the threshold value is done [13]

3. METHOD COMPARISON

3.1 Based on Range

Color space	Nominal Range	White	Yellow	Cyan	Green	Magenta	Red	Blue	Black
R	0 to 255	255	0	0	0	255	255	0	0
G	0 to 255	255	255	255	255	0	0	0	0
B	0 to 255	255	255	0	0	255	0	255	0
Y	16 to 235	180	162	131	112	84	65	35	16
Cb	16 to 240	128	42	156	44	184	100	212	128
Cr	16 to 240	128	142	44	58	198	212	114	128
H	0 to 360	-	60	180	120	300	0	240	-
S	0 to 1	0	1	1	1	1	1	1	0
v	0 to 1	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0

3.2 Based on Advantage and Disadvantage

Method Type	Method Name	Advantage	Disadvantage	Reference
	Face detection from skin color on RGB, YCbCr, and HSI.	All three method can match to original skin color and detect the human face.	Only match to skin color based.	**[2]**
	Face Detection from Skin Regions	Skin regions threshold value match to the original skin regions value and easily detect the human face.	Only match to skin color regions	**[3]**
	Face Detection From Eye Regions	Eye regions threshold value match to the original eye regions value and easily detect	From Morphological Process it is difficult to detect the faces	**[4]**

		the human face.		
Color Image	Grab Cut	Image is convert in foreground and background image then easy to detect the face.	It only use for foreground and background	**[5]**
	RGB-HSV-YCbCr	To overcome this problem, RGB-HS-YCbCr method is used.	The problem is to detect faces in the given colored group photograph	**[6]**
	Face Detection using Skin based segmentation	Easily detect the human faces with the algorithm of skin based segmentation.	There is a chances of getting the false result with this algorithm.	**[7]**
Binary Image	LBP	After taking the threshold value it is easy to detect the face.	In this to detect the face it is compulsory to take the threshold value.	**[10]**
	PCA	Image is not match that time to process will be continues try to match the image until match is found.	Image match time is more consume. Test image is reduce the length of feature vectors	**[13]**

4. CONCLUSION

This paper concluded some problem in segmentation of skin color such as skin color and background color of image are same. The problem in face detection technique is time consuming process compared to color skin technique. In this paper we reviewed the work on the color image and binary image. In future we will extend our task on face detection algorithms. Here some methods like RGB, YCbCr, HSI, LBP, and PCA etc. From these all LBP method provides better results.

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