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Face Detection Using Gabor Wavelet Transform with Histogram of Local Binary Pattern with Dominant Color Descriptor

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***Abstract*— Machine learning (ML) assignments are normally characterized into three general classifications, rely upon the life of the learning "flag" or "input" accessible to a learning framework. In ML, Gabor wavelet transform are supervised learning models with related learning calculations that examine information utilized for categorization and regression investigation. This research investigates the use of ML for biometric and object recognition. Examples are shown using this type of system in biometric application and in detecting face object. With the known dataset of images with known classifications, a system can predict the classification of new images. This study recommends face detection using Gabor Wavelet Transform technique with Histogram of local binary pattern (HOLBP) with Dominant Color Descriptor (DCD). The face detection (FD) approach is the way of skin color region segmentation has been considered in different perspectives: complex background pictures because of the area whose color is similar to the skin color cause high false positive rates. In this research, FD system is produced with the training of a Gabor wavelet transform classifier based on face properties related with DCD and a spatially enhanced local binary pattern. In Gabor wavelet transform approach, cross-validation process related with the Bao Database of user face properties which is used for solving classification precision problems. The implementation outcomes proved that the classification time reduced with an increase in the detection rate. The data collection of both the low-resolution and the high-resolution face image samples, the precision of FD system was over 89% with k-fold cross-validation scheme for an image data size of 450 and 400, respectively. Overall, the proposed algorithm provided a higher precision of FD compared with the precision for low-resolution face image (approximately 85%) of the existing schemes. This work presented a method to control the window size and detection area of a cascade classifier by detecting and using the skin color region with the pressing time reduced.**

Keywords—ADTMF, Gabor wavelet transform, Skin Model, Morphology, Face Detection, DCD, HOLBP.

I. INTRODUCTION

Face detection is a technology to determine if a static image includes a face and detects it. A face may be seen differently depending on changes in its size, horizontal or vertical turning, profiles and front faces, facial expressions, light conditions,etc., which causes various challenges in face detection research works. Accordingly, because of the difficulty in and the importance of face detection, this area of research is regarded as an independent sector rather than a preliminary step of face recognition. Recently, the areas of face detection application have continued increasing [1]. In MPEG-7, DCD provides an effective, compact, and intuitive salient color representation, and describe the color distribution in an image or a region of interesting [2]. This feature descriptor contains two main components: (1) representative colors and (2) the percentage of each color. In this paper, we will develop an effective color and texture extraction scheme, and improve similarity measure for DCD and HOLBP. Skin color has proven to be a useful and robust cue for face detection, localization and tracking. Face detection techniques based on the use of color information have been proposed [3-4]. Several color spaces have been proposed, for instance RGB, normalized RGB, HSV, XYZ and YCbCr. In this paper we discuss ADTMF-based skin detection methods that classify each pixel as skin or non-skin individually. Machine learning methods can be efficiently used for feature extraction and classification and therefore are directly applicable to biometric systems. Biometrics deals with the recognition of people based on physiological and behavioral characteristics. Biometric recognition uses automated methods for recognition and this is why it is closely related to machine learning [5]. There are so many methods in machine learning like Neural Network, Gabor wavelet transform, and Optimization algorithm. Gabor wavelet transforms are "close relative" to neural networks and can be considered as an alternative training method for classifiers with polynomial functions, RBFs and for MLP classifiers [6].

II. SKIN MODEL

Skin model is the process of choosing different color models like RGB, HSV (hue, saturation and value) and YCbCr. Among these models, YCbcr color space describes the luminance information from chrominance information and a linear conversion of an RGB color model is possible and it is used for simplicity and minimal method. The main aim is to eliminate similar skin color region excluding face skin. This method is used to produce the maximum face window of skin color areas. The new way to reduce the computation time of skin color detection to the improved skin color segmentation algorithm is presented. If a skin area to be scanned using improved skin color region is reduced from the whole image to the specified portion, the speed is enhanced according to this process.

2.1. Skin Region Segmentation Method

YCbCr stands for Y is luminance value; it is slightly related to the skin color, the main issue in Cb and Cr chrominance value. The value of Cb and Cr is far smaller than that of RGB values and it is well suited for the skin color modeling of the skin region segmentation.

2.2. Morphological Method

The main focus of morphological operation is to alter the pixels into easy way with the elimination of unwanted regions. This method can work on shape feature and discard all irrelevant information. In this approach, use erosion and dilation method to remove irrelevant regions. The Fig9, shows that the effect of morphological method [7].

2.3. Median Filter Method

Median value is the value in the middle position of any sorted sequence [8]. Image de-noising approach based some median filter have been proposed, some median filter are application oriented. Some of the significant methods have been explained below.

2.4. Adaptive Dual Threshold Median Filter Method (ADTMF)

De-noising method is a method based on median filter with adaptive dual threshold. In single threshold system, when central pixel is checked for the presence of noise, any pixel value lesser than (or greater than) the given single threshold will be considered as noise. In this system, the pixel values range used for noisy pixels recognizing will be large. This may increase the possibility of incorrect detection. [9]

III. FEATURE EXTRACTION

3.1. Histogram of Local Binary Pattern (HOLBP)

LBP was initially used for texture description. It worked on monotonic grayscale transformation for texture features. LBP is made an easy to extract texture features in digital image. This method is splitting the complete image into several small regions which is called image features. These regions contain detailed of binary pattern that describe the environmental backgrounds of image pixels in the regions. These features are grouped into a single feature histogram that describes the image representation. In this method, calculate the distance between their histograms. Using HOLBP, performance and speed was increased, face detection collect positive results. It is robust against single face and multiple face images with different facial pose, lightening conditions. [10]

3.2. Dominant Colour Descriptor (DCD)

DCD is one of the color descriptors proposed by MPEG-7 that has been extensively used for image retrieval. Among the color descriptors, DCD describes the salient color distributions in an image or a region of interest. DCD provides an effective, compact, and intuitive representation of colors presented in an image. To extract dominant colors from an image, color quantization method has to be predetermined. Using this algorithm merge the clusters and represent colors in a small number and their percentage of an image can be produced.[12] The DCD in MPEG-7 is described as:

$$F = \{\{c_i, p_i\}|, i = 1, \quad (1)$$

Where N is the total number of dominant colors for an image, is a 3-D dominant color vector, pi is the percentage for each dominant color, and the sum of is equal to 1.

IV. FACE DETECTION PROCESS

This study, the skin color region classifier is used as a preliminary step to improve the speed of face detection through the learning process rather than as a step to confirm the location or existence of a face. Thus, areas smaller than 24×24, which is the minimal size of a face according to face learning data collected by the face detector, are removed. In the skin color region classifier, used as a initial step to enhance the process of face object detection using the Gabor wavelet transformation process. Thus, areas smaller than , which is the frontal face detector size according to the Voila-Jones algorithm. For this reason, remove regions which are not to be face and then lets the SVM based face object detector detect faces from skin color regions. The expression of removal is shown in Eqn 20. In Fig 9, display areas that go through the connection element labeling method and the non-skin region rejection process.

V. MACHINE LEARNING ALGORITHM

5.1. Support Vector Machine

Linear SVM is the simplest type of SVM classifier which separates the points into two classes using a linear hyper plane that will maximize the margin between the positive and negative set. The concept of non linearity comes when the data points cannot be classified into two different classes using a simple hyper plane, rather a nonlinear curve is required. In this case, the data points are mapped non-linearly to a higher dimensional space so that they become linearly separable.[13]First, the sample data vectors are projected onto a very high-dimensional space. The dimension of this space is significantly larger than the original data space. Second, the algorithm finds a hyperplane in this new space with the largest margin (linearly) separating classes of data. Classification accuracy usually requires a sufficiently high dimensional target space. This scalar product can be defined by introducing a kernel function (x.x') = K(x, x'), where x and x'are a pair of vectors in the low-dimensional space for which the kernel function K corresponds to a scalar product in a high dimensional space. Various kernels may be applied, and this characterizes the different kinds of SMs approaches.[14].

VI. PROBLEM DEFINITION AND OBJECTIVE OF PROPOSED WORK

Face detection can be regarded as a specific case of object class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Face detection can be regarded as a more general case of face localization.[13] The suggested face detection model is also better in terms of calculation of time efficiency. Skin colors were commonly used as a basic element for efficient characteristic-based face detection in existing face detection researches .For decades of years,

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various skin color-based face detection algorithms have been designed in utilization of different color models. However, the skin color feature is apt to be affected a lot by complicated backgrounds or regions whose color is similar to a skin color in an image. When such portions are large in an image, therefore, the false positive rates would be high with detection rates decreasing. In contrast, the appearance-based face detection method, which mainly adopts the sliding window, shows high face detection rates but the operation requires high computational costs at the same time because its cans the entire image and uses the learning data. Hence, as the image size increases, the scanning process requires high computational costs and more processing time. Further, the efficiency is low as it examines regions that are not asked in color region and thus cannot be an actual face region without color information applied in the learning and detection process.

This issue can be solve in this proposed with the improved process of skin segmentation and detection. In this approach, we removed small holes using filtering process. Finally, we detect all faces in the whole image with the minimum computational cost and high detection rate.

VII. EXITSTING WORK

[15]The main focus of this work is on frontal faces for detection. Using Viola-Jones algorithm mixed with three-heuristic. In this calculated using depth map which is the main aim of obtaining accurate face detection with few false positives. But, the minimization problem was computationally expensive. On the other hand, many drawbacks in this approach like CPU cost and memory resources.

[16]In this paper it proposed a new method for skin detection in color images which consists in spatial analysis using the introduced texture-based discriminative skin-presence features. This approach did not work on non-face images because of illumination.

[17] This paper employs an edge-based Gabor feature representation approach for the recognition of surgically altered face images. It used the edge information, which is dependent on the shapes of the significant facial components, to address the plastic surgery-induced texture variation problems. This process was texture insensitive and illumination invariant processes into a single processing step and investigates its performance with other plastic surgery procedures and cases of gross illumination problems.

[18]In this paper, Principle Component Analysis (PCA) is used to play a key role in feature extractor and the Gabor wavelet transforms are used to tackle the face recognition problem. MLP is sensitive to feature scaling.

[19] It used skin color model in YCgCr color space to detect candidate face region in the tested image, and then further verifies the face region by the Adaboost algorithm with the added new feature. It worked only on frontal faces not for detects faces that are upright and forward facing.

[20] In this paper, it presented a methodology for face recognition in the presence of space-varying motion blur comprising of arbitrarily-shaped kernels. It modeled the blurred face as a convex combination of geometrically transformed instances of the focused gallery face, and show that the set of all images obtained by non-uniformly blurring a given image forms a convex set. The limitation of this approach is that significant occlusions and large changes in facial expressions cannot be handled.

VIII. PROPOSED METHODOLOGY

Face detection has been examined in various perspectives. It is categorized into four major processes: preprocessing stage, feature extraction process, feature selection process and feature classification process.

1) Preprocessing Stage- In this stage, first take an image and is to be filtered by adaptive dual threshold median filtering. After that resize the image in the standard size. This stage is repeated for train images also. In the proposed method, the morphed image is partitioned into sub-images (filtering windows). For any given N X N gray level image which is defined by where I = [a, b] represents the range of pixel values. Pixel value at location (i, j) is given by f(i, j).

Let r X r be size of the filtering window ‘‘W’’, formed by partitioning of an image.

Average values of a set of samples (data values) always lie in close proximity to the values under consideration. Averages of rows and columns of filtering window are used for threshold computation in proposed method which leads to efficient noise detection. In each filtering window, Th_{min} (minimum threshold) and Th_{max}(maximum threshold) are estimated which are used to abrupt changes detect in pixel values.

2) Feature Extraction- In this stage, filtered image is used for feature extraction process. Extract the features of an image using DCD method and HOLBP. This method does not degrade the quality of an image.
3) Feature Selection- This stage select feature of an image using Manhattan distance. These distances is used for selecting test image feature and database image feature and calculate distance between test image and database image.
4) Classification- In this process classifies data using Kernel of Gabor wavelet transform. It accomplish pattern recognition between two classes by finding a decision surface that has maximum distance to the closest points in the training set which are termed Gabor Wavelet.

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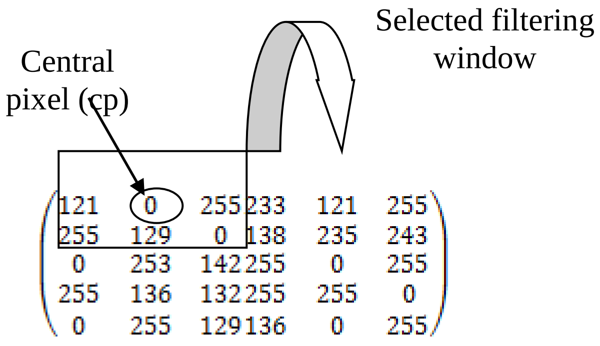
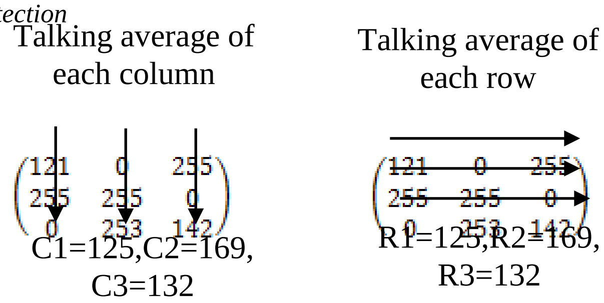
ILLUSTRATIONS

Illustration: Case1

STEP-1: A filtering window is selected



STEP-2: Now dual threshold values are computed for noise detection

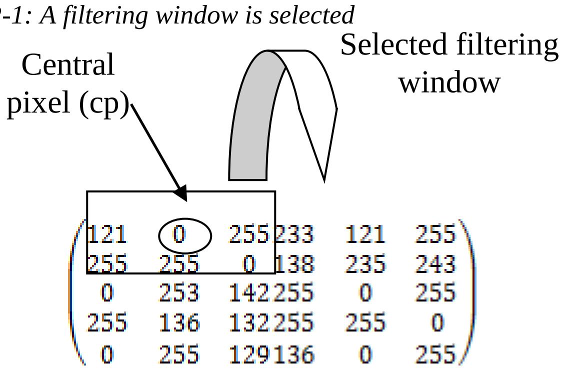


STEP-3: Existence of noise is checked by comparing the Central Pixel (CP) with thresholds

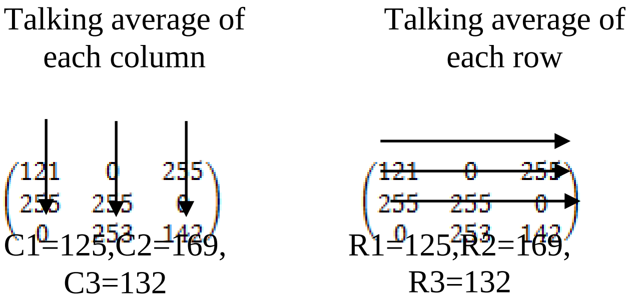
STEP-4: Here value of CP lies in between the two different thresholds, the CP is considered to be noise free and remains unchanged

Illustration: Case2

STEP-1: A filtering window is selected



STEP-2: Now dual threshold values are computed for noise detection



STEP-3: In this step, existence of noise is checked by comparing the CP with thresholds
STEP-4: Since the CP value is not lying in between the two thresholds, the central pixel (CP) is considered to be noisy
STEP-5: Since the CP is noisy, it will be replaced by median value of filtered window i.e. 142

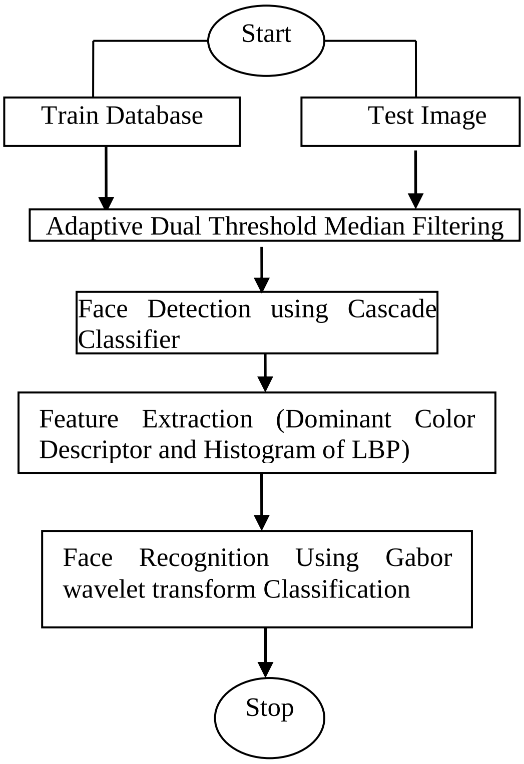


Fig1.5. Flow chart of Proposed Algorithm

Proposed Algorithm

1. Consider 'I (x)' as the intensity value of image.
2. Calculate the color cast with the use of the mean RGB value for I(x).

$$Mean = \sum_{i=}^{M} \quad (1)$$

Where is enhanced image, M N is total number of pixels.

3. Find the inverse ‘ ’ of all mean values using below equation:

(2)

4. Determine the maximum ‘ ’ value among smallest average mean value by this formula:

$$Max = \text{m} \quad (3)$$

5. Scaling factor is the ratio of inv to max. It is updated value of mean.

$$M \quad (4)$$

6. Scale the values to obtain final gray image.

$$out = \quad (5)$$

7. Convert RGB to YCBCR image.
8. The Cb and Cr values is determined by this equation:
$69 < Cb < 130$

$$130 < C \quad (6)$$

9. Mark only skin pixels and store ones in the matrix as a binary image. It contains the skin map overlayed onto the image with skin pixels marked in blue color.
10. If Out is logical and the structuring element is flat, imerode performs binary erosion; otherwise it performs grayscale erosion. If structuring element (SE) is an array of structuring element objects, imerode performs multiple erosions of the input image, using each structuring element in SE in succession. Final eroded image is stored in ‘L2’ variable.
11. Calculate the threshold using Otsu method.
12. Determine the size of rows, columns of L2 image. Obtain binary image:
FOR i=1:rows
FOR j=1:columns
IF L2>threshold
$\boldsymbol{Binar\,y_{img}\,(i,j) = 1}$
ELSE
$\boldsymbol{Binar\,y_{img}\,(i,j) = 0}$
END
END
END
13. Consider that the gray levels of any pixel value, in any window ( ) of size n are represented by $Binar\,y_{img\,1}, Binar\,y_{img\,2}, Binary_{img_3}, Binar\,y_{img\,4}, \ldots X_1$ and it becomes $Binar\,y_{img\,i1} \geq Binar\,y_{img\,i2} \geq Binary_{img\,i3} \geq \cdots \ldots \ldots Binar\,y_{img\,in}$
after sorting it in descending or in an ascending order

$$M_X = Median\ (W_X) = \begin{cases} Binar\,y_{img\,i(n+1)/2;} & n\ is\ odd \\ \frac{1}{2}\left[Binary_{img\,i\left(\frac{n}{2}\right)} + Binar\,y_{img\,i\left(\frac{n}{2}\right)+1}\right]; & n\ is\ even \end{cases}$$

(7)

A generalized filtering window ‘‘W’’, is given in Eq. (8), it has rxr matrix. The gray level at any pixel (i,j) is represented by $Binar\,y_{img}$ (i,j)

$$\text{x} = \text{Binary}_{\text{img}}$$

$$w = \begin{bmatrix} x_{1,1} & x_{\left(1,\frac{r+1}{2}\right)} & x_{1,r} \\ x_{\left(\frac{r+1}{2},1\right)} & x_{\left(\frac{r+1}{2},\frac{r+1}{2}\right)} & x_{\left(\frac{r+1}{2},r\right)} \\ x_{r,1} & x_{\left(r,\frac{r+1}{2}\right)} & x_{r,r} \end{bmatrix} \quad (8)$$

14. In order to estimation thresholds, first of all, the elements averages in individual rows (A_v(R)) of filtering window are calculated.

$$A_v(R_r) = \frac{1}{r}\sum_{j=1}^{r} x(r,j) \quad (9)$$

15. This process will result ‘‘r’’ average values corresponding to every row. After that the averages of elements in individual columns (A_v(C)) of filtering window are calculated.

$$A_v(C_r) = \frac{1}{r}\sum_{i=1}^{r} x(i,r) \quad (10)$$

16. This process will also result ‘‘r’’ average values corresponding to every column. These ‘‘2r’’, distinct average values will be used for finding Th_{min} and Th_{max} using following equations:

$$Th_{min} = min\{A_v(R_1), \ldots A_v(R_r), A_v(C_1), \ldots A_v(C_r)\} \quad (11)$$

$$Th_{max} = max\{A_v(R_1), \ldots A_v(R_r), A_v(C_1), \ldots A_v(C_r)\} \quad (12)$$

17. Now, the noise corruption at CP of filtering window is checked by comparing it with Th_{max} and Th_{min}. If CP value lies between thresholds computed by Eqs. (11) And (12), then it is considered as noise free otherwise noisy.

$$CP = \begin{cases} Th_{min} < CP < Th_{max}; & Noisefree \\ Else; & Noisy \end{cases} \quad (12)$$

If the CP is estimated as noisy, then the noise removal is need to be applied at specific CP, otherwise it is kept same and filtering window is shifted to the next pixel. At noise elimination stage, simple median (M) of the filtering window has been used to change the gray level of the detected noisy pixel.

18. Find the ‘num’ denotes the number of connected objects and labels in binary image ‘L4’.
19. Find the area using regionprops function.

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20. Eliminate the noisy regions from binary image using this process:

```
Input: removed=0, L4, Area, num
Output: L4
FOR i=1:num
dd=STATS(i).Area
IF (dd<35000 && dd>45000)
L4(L4==i)=0
removed++
num- -
ELSE
END
END
```

21. *Draw the bounding box around the face object.*
22. Returned only detected face object.

From Fig 2 , shows that partitioned the determined filter window to cells. Compare the pixel to every of the 8 neighbors (top left, bottom left, top right, middle left) for every single pixel in the cell. The pixels is moving in the form of circle in the matrix, i.e. clockwise or anticlockwise direction. If the center pixel value is higher than neighbor, then mention that with “1”, otherwise “0”.

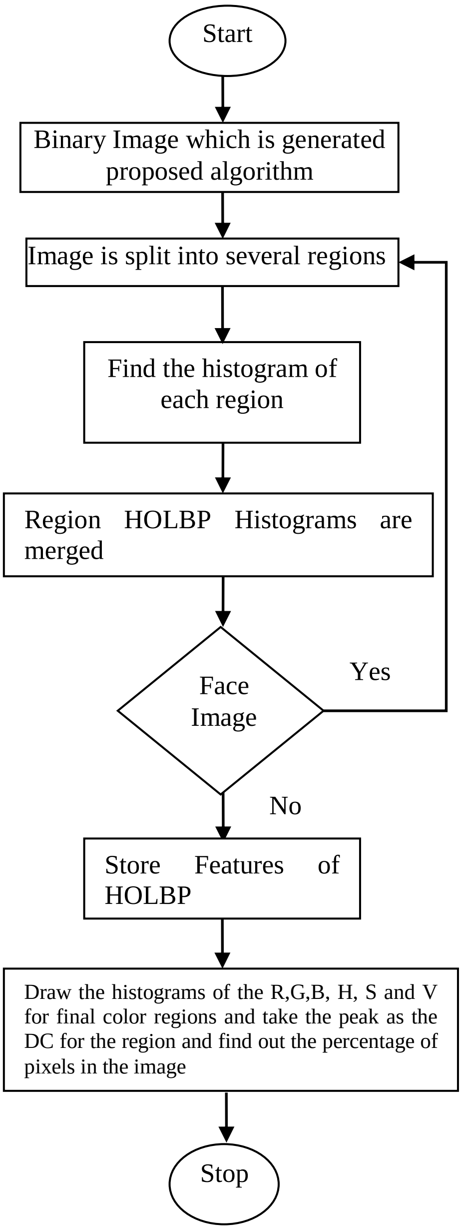

Fig.2 Flow Chart of HOLBP and DCD Method

This returns the eight-bit binary number. Calculate the histogram of each number. It combined the normalized histograms of most cells. This gives the feature vector for the window.

The detailed DCD method is as follows:

In this method, take R,G,B, H, S and V components then divide into 8 coarse partitions. After this process, the centroid of each partition (‘‘colorBin’’ in MPEG-7) is selected as its quantized color. Let U = $(U^R, U$ represents color components of a pixel with color components red, green, blue, hue, saturation and value respectively, and $c_i = (\overline{U^R}, \overline{U^G},$ be the quantized color for partition i. The average value of color distribution for each partition center can be calculated by

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$$\bar{l} \tag{13}$$

$$U^R = U_1^R \times \left(\frac{p_{R,1}}{p_{R,1}+p_{R,2}}\right) + U_2^R \times \left(\frac{p_{R,2}}{p_{R,1}+p_{R,2}}\right),$$
$$U^G = U_1^G \times \left(\frac{p_{G,1}}{p_{G,1}+p_{G,2}}\right) + U_2^G \times \left(\frac{p_{G,2}}{p_{G,1}+p_{G,2}}\right),$$
$$U^B = U_1^B \times \left(\frac{p_{B,1}}{p_{B,1}+p_{B,2}}\right) + U_2^B \times \left(\frac{p}{p_{B,1}}\right. \tag{14}$$

$$U^H = U_1^H \times \left(\frac{p_{H,1}}{p_{H,1}+p_{H,2}}\right) + U_2^H \times \left(\frac{p_{H,2}}{p_{H,1}+p_{H,2}}\right),$$
$$U^S = U_1^S \times \left(\frac{p_{S,1}}{p_{S,1}+p_{S,2}}\right) + U_2^S \times \left(\frac{p_{S,2}}{p_{S,1}+p_{S,2}}\right),$$
$$U^V = U_1^V \times \left(\frac{p_{V,1}}{p_{V,1}+p_{V,2}}\right) + U_2^V \times \left(\frac{p_{V,2}}{p_{V,1}+p_{V,2}}\right)$$

In Eq. (14), pR, pG, and pB represent the percentages in R, G, and B components, respectively.[11]

IX. RESULT ANALYSIS

This algorithm was tested upon 274 images collected online as well as Bao database using the face detector that utilizes the Cascade classifier. Face detectors that use skin region model that merge with the DCD. In addition, the HOLBP feature is used, and the execution change is demonstrated when it is connected to different sorts of face detectors [21].This experiment contain single faces, multiple faces. This study decreases the identification area to enhance the speed and keep up the face detection rates. The accompanying investigation demonstrated this. Determine the similarity matrix of face image and image database using Manhattan distance (MD). We have used MD which is the most predictable metric for calculating the lack of involvement between two vectors. Given two vectors *F* and D, where

$$d(F, D) = \textstyle\sum_m \sum_n d \tag{15}$$

Where

$$d_{mn} = \frac{|(\mu_{mn}^F - \mu_{mn}^D)|}{|\mu_{mn}^F| + |\mu_{mn}^D|} + \frac{|(\mu_{mn}^F - \mu_{mn}^D)|}{|\mu_{mn}^F| + |\mu_{mn}^D|}$$

24. Repeat the steps from 2 to 20 for all the images in the database.
25. Classify the images using Kernel SVM.
26. Calculate positive predictive value (PPV), correct detection rate (CDR), execution time and negative predictive value (NPV) of detected image.

$$PPV = \frac{No.\ of\ relevant\ image}{Total\ number\ of\ image} \tag{16}$$
$$NPV = \frac{No.\ of relevant\ image}{number of image\ in\ th} \tag{17}$$
$$CDR = \frac{}{(T} \tag{18}$$

Where Confusion matrix consists of four variables namely:

1. True positive (TP): The percentage of total number of genuine images taken as genuine, closer to 1 is better.
2. True negative (TN): The percentage of total number of genuine images taken as forged, closer to 1 is better.
3. False positive (FP): The percentage of forged images taken as genuine, closer to 0 is better.
4. False negative (FN): the percentage of forged images taken as forged, closer to 0 is better.

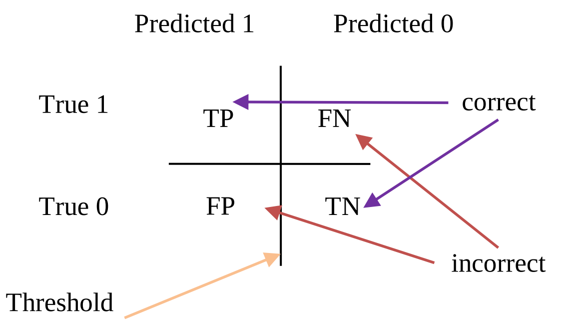

Fig.3 Confusion Matrix

	Predicted 1	Predicted 0	
True 1	0	FN	Threshold>MAX(F(x)) All cases predicted 0 (FN+TN)=total FDR=%False=%0's
True 0	0	TN	

Fig4. Predictive Threshold

	Predicted 1	Predicted 0	
True 1	TP	0	Threshold<MIN(F(x)) All cases predicted 1 (TP+FP)=total CDR=%True=%1's
True 0	FP	0	

Fig5. Predictive Threshold

X. COMPARATIVE TABLES

The number of faces in an image also may be varied just as the proportion of faces. Images were grouped depending on the number of faces in the image, and the level of performance improvement of each group was measured. As in the previous experiment, when the processing time of the basic sliding window type of face detector that did not apply the skin color region classifier was 100%,that of the sliding window type of face detector that applied the suggested skin color region classifier was presented as a portion of it in percentage. In the experiment, a test was conducted among the images in Bao database by means of the face detector with learning ability in application of the DCD and HOLBP feature. The examples of part experimental result show in Figure 6. Experimental results using the proposed method show that the new approach can detect face with high

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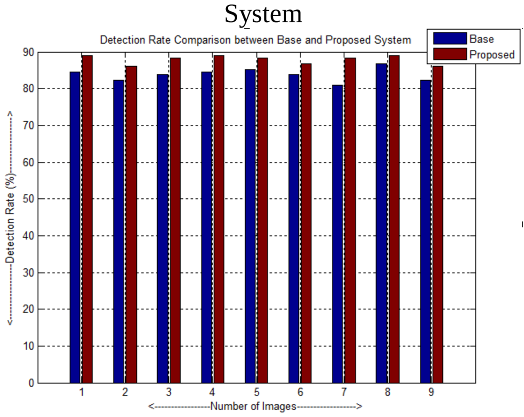
detection rate and low false acceptance rate. But false alarms and misses still exist. The statistical data is shown in Table.1

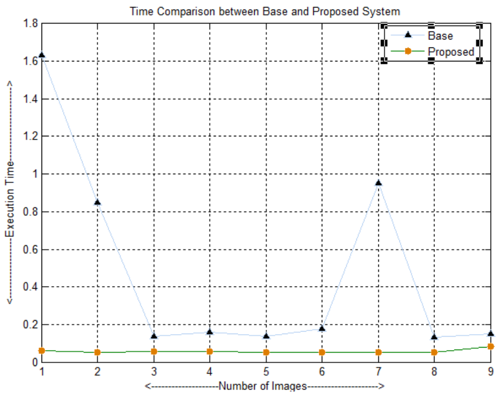
Train Image	Base Detection Rate (in %)	Proposed Detection Rate (in %)	Base Execution Time	Proposed Execution Time
Image(a)	84.56	89.05	1.6314	0.0596
Image(b)	82.35	86.13	0.8470	0.0527
Image(c)	83.82	88.32	0.1373	0.0540
Image(d)	84.56	89.05	0.1597	0.0552
Image(e)	85.29	88.32	0.1379	0.0511
Image(f)	83.82	86.86	0.1766	0.0531
Image(g)	80.88	88.32	0.9506	0.0532
Image(h)	86.76	89.05	0.1303	0.0525
Image(i)	82.35	86.13	0.1493	0.0830

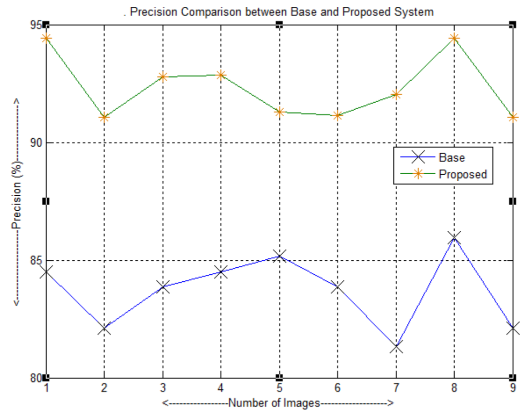
Table1. Detection Rate and Time Comparison between Base[1] and Proposed System

Train Image	Base Precision (in %)	Proposed Precision (in %)
Image(a)	84.50	94.44
Image(b)	82.09	91.07
Image(c)	83.85	92.79
Image(d)	84.50	92.86
Image(e)	85.16	91.30
Image(f)	83.85	91.15
Image(g)	81.34	92.04
Image(h)	85.94	94.44
Image(i)	82.09	91.07

Table2. Precision Comparison between Base[1] and Proposed System







XI. CONCLUSION

The proposed face detector (FD) is superior to the existing FD in respect of the detection rate of the FD result. The proposed FD model is also better time efficiency. This study employs many advanced techniques for improving detection rate and computational time of FD system. In Gabor Wavelet Transform method, 274 images was used for cross-validation scheme verification and favorable 274 experimental results were obtained. This work is applied on 274 images to the face detector with learning data in utilization of the DCD and HOLBP features among the existing sliding window type of face detectors, and the evaluation of this work was demonstrated in a series of experiments. In this investigation, we detect all faces in an image. The execution time for a pixel of size 400*400 is 0.0527 ms; the average detection rate in Bao database is 94.44%. The investigational outcomes demonstrate that the method mentioned in this algorithm can reach improve detection rate. Furthermore, hybrid this approach with other FD approach for improving good result and decrease the false detecting rate in dealing with images with more difficult background. This work will reach out to gathering a bigger dataset and the framework to deal likewise with non frontal upright countenances. Another future work will test distinctive and all the more performing face finders, for decreasing the quantity of false negatives.

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