Implementation of Face Identification based on Color spectral and Local Texture Features

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***Abstract*— The local pattern is the interesting term in face recognition and widely used for biometric and surveillance purpose so it received more popularity in terms of face identification and image analysis. Along with local pattern use of color textures improve quality of recognition by increasing correctness of analysis. In this paper we discuss various approaches that already implemented in face recognition to use these ideas in new task. It study various methods of color local texture feature extraction like LBP and Gabor wavelet and color channel fusion using techniques like PCA, LDA, Gabor wavelet. This paper gives implementation of face recognition using texture features and color information. It represents implemented technique using local pattern improves result than other existing technique upto 5 to 7 %.**

***Keywords*— Face recognition, local pattern, color channel fusion, Principal component analysis, and Gabor wavelet.**

I. INTRODUCTION

Face recognition continuously shown its importance in various sector since last few years. Not only for biometric and pattern recognition but also for e-passport and security, face recognition done vital role in personnel identification. In traditional face recognition, only grayscale images are used for identification and important information extracted from that images. Various effective feature extraction schemes applied one by one on one dimensional and further on two dimension images. Normally in face recognition first normalized the input image in absolute dimension and exploits one of the feature extraction methods on that image to reinforce separate ability between pattern classes to maintain and add features and make pattern separable.

It is recognize later that color component in color image spectral may also used for recognition as color provides vital information for indexing and retrieval, segmentation, detection, and recognition. Different characteristics are extracted from different visual task of various types of color spaces like YC_bC_r, HSV, and RGB. Depend on the required features and variation effect appropriate method of extraction and recognition has been applied on image. Reduction and classification can enhance the recognition rate using color information along with luminance and pose information. Principle component analysis (PCA) is also more useful when these two information used for extraction.

In recent hybrid techniques of face recognition and fusion of extracted features i.e weighted combination of features from different channels according to importance are taken. This paper focus the methods proposed earlier about the color face recognition and local texture feature in II. Proposed scheme of color channel fusion of local texture features (LBP and Gabor Wavelet) in III. Discuss the result of implemented techniques in IV. Going further conclusion and references are in V and VI respectively.

II. LITERATURE SURVEY COLOR SPECTRAL AND TEXTURE FEATURE

Approaches and ideas already work out previously to be explained here to find out new ideas and progress our task. It is an overlook on the previous task done by various authors and collection of data from their researches. This session represents a contribution of authors in the area of face recognition.

G. Paschos has been presents an evaluation study **in [1]** that represent color texture analysis method and analyze result of various color space on that method. It compare effectiveness among various color spaces, especially two perpetual uniform spaces i.e L*a*b and HSV against generalized RGB color space. A family of Gabor filter uses in the presented methodology as early

stage of human visual system to measure specific orientation and size of images. A color texture opposes to grayscale texture where only luminance is considered. The very first step mention in evaluation method is filtering which has been done using Gabor filter by separating positive and negative ones with calculating corresponding individual color points called weighted color difference. The technology applied to extend feature vector from each pixel of image of multidimensional space. Gabor filter with four orientation of 0^0, 45^0, 90^0 and 135^0 and three color component are used. Pixel-wise classification gives low correctness classification rate due to overlaps in the feature space. To improve this result block wise classification is used.

O. Ikeda in [2] describes the image detection from the video footage by implementing segmentation method. Also comparison has been done among RGB, HSV And YC_bC_r colors for convenient color segmentation. Video footage may be illuminated and may other objects similar to background frames included in that video. Video footage frames may vary with respect to color, texture and directions so, single set of segmentation is not sufficient to accurately retrieve image. This paper not only analyzed capability of segmentation but also construct a system for image retrieval. The system first detects scene change and scanning of sampling point at beginning of new scene. Then segmented image checked for requirements and calculate pattern correlation for the frame. Considered the output with largest correlation and displayed according to correlation values. Experimentally it shows that HSV colors extract more features than RGB and YC_bC_r colors and also most reliably segmented face images.

In [4] J. Choi et.al, carry out extensive and systematic studies to explore the facial color effect on recognition due to variation in face resolution. This paper demonstrated effect of color on low-resolution faces by comparing color and grayscale features. This paper subjected into two parts- 1) derivation of variation ratio gain (VRG). 2) Performance evaluation by extensive and comparative face recognition. The effectiveness of color has been tested successfully on three subspace face resolution methods—principal component analysis, linear discriminate analysis, and Bayesian. To accurately recognize face recognition, effectively use color feature to reduce lower bound. The proposed color face recognition method improves degraded recognition accuracy due to low resolution faces by significant margin compared to intensity-based face resolution.

In [5] J. Y. Choi, et al. proposed an effective FR method based on the selection of the best color-component features using the proposed variant of boosting learning framework. These selected color-component features are combined into a single concatenated color feature using weighted feature fusion. Most of the existing color FR methods are restricted by using a fixed color-component configuration comprising of only “two” or “three” color components like YQCr from YCbCr and YIQ. Here results clearly demonstrate the effectiveness of the proposed method in terms of both absolute and comparative performance against state-of-the-art color FR methods. In this paper, the extraction of color-component features is confined to using global-based feature extraction methods.

In [6], S. H. Lee, et.al. Proposes a novel face descriptor based on color information for face recognition (FR) called local color vector binary patterns (LCVBPs). LCVBP consists of two discriminative patterns: color norm patterns and color angular patterns. In order to perform FR, the proposed LCVBP feature is generated by combining multiple features extracted from both color norm and color angular patterns. They have proposed a novel face descriptor named LCVBP. To perform multiple features derived from the preceding binary patterns are combined at feature level, leading to the maximization of the complementary effect for FR. Extensive and comparative experiments have been conducted to evaluate the LCVBP feature on five public databases. Experimental results show that the LCVBP feature is able to excellent FR performance for challenging face images. In addition, the effectiveness of the proposed LCVBP feature has been tested successfully by comparing other state-of-the-art face descriptors

J. Choi et.al, in [7], represents two types of color features extraction from individual color channel of multi spectral colors. The color information which are tried to extract is extended form of the grayscale features. These two commonly used techniques are Gabor feature and Binary Pattern which is nothing but Color Local Gabor Wavelets and color local binary pattern as they uses color information.
*1)Extraction of CLGW 2)*Extraction of Color LBP *3)Combining Color Local Texture Features For FR*

In [9], Ze Lu et.al, a color channel fusion method is proposed to make use of reliability and importance of features in different color channels. The fusion of color channel is an important step in proposed color face recognition (FR) systems. Existing methods identifying the importance of features however it concentrate on channel wise feature extraction rather than identifying reliability of features on separate color channels. This paper simply a color channel fusion (CCF) approach along with dimension reduction to select more vital features from discriminative channels. By integrating the dimension reduction rule of a single color channel across all three color channels, a more effective channel fusion method is achieved. The effectiveness of proposed color channel fusion approach is validated by applying it to two quite different dimensionality reduction methods (PCA and ERE) using two different types of features i.e image-pixel values and color local Gabor Wavelets. It show that CCF achieves consistently better performance than color channel concatenation (CCC) method which deals with different color channels

equally. It outperforms CCC method and WDF method in the field of dimension reduction, types of features and image variations.

III. PROPOSED SCHEME

In our proposed method HSV color channel fusion has been perform and color local texture features retrieve from each local region of that channel. CMU PIE, or FERET datasets are used for experiment of face detection. Two types of color features i.e color local binary pattern and color Gabor texture wavelet are extracted from color spectral. PCA is most commonly used technique for reduction which is used here to get more accurate features from face images.

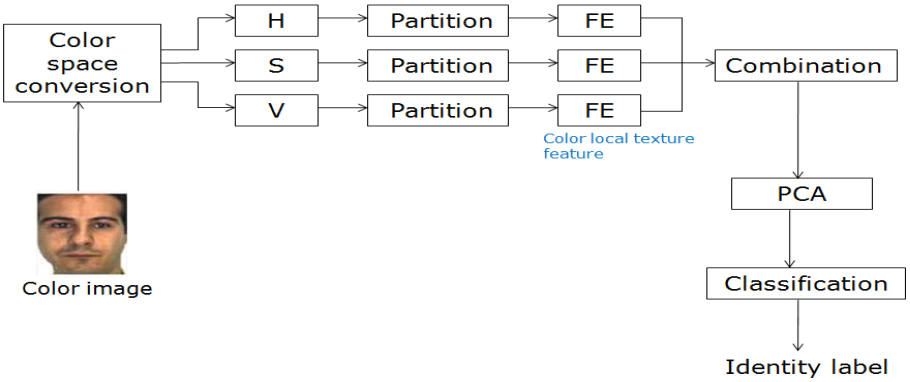

Fig1: Color Face Recognition System using local texture feature

Proposed face recognition scheme divided in five major steps:

- Color Space Conversion And Partitioning
- Color Feature Extraction
- Combination and Dimensionality Reduction
- Classification

A. Color Space Conversion And Partitioning

Step 1:CMU-PIE and FERET: These Two databases are used to perform face recognition. For testing image use 10 images of each person with different to identify it.

Step 2: Color Space Conversion: By resembling and translating align color face images in RGB to a fixed template in first step. HSV is used widely for recognition as it represent images in the form of different color shades whereas, RGB color space are relatively weak color space due to correlation between color channels. Subsequently performed a color space conversion to convert an RGB image into in a new color space image, So here we convert RGB image To HSV image.

Step 3: Color Channel Separation and Partition: HSV image are separated to each channel i.e H- Channel S- Channel and V-Channel. Each spectral of color are partitioned into a standard local regions to extract more accurate features and reduce computation complexity.

B. Color Feature Extraction

Texture feature of local binary pattern and Gabor wavelet texture features are computed separately for each region. CLBP and CGTW extracted independently from these regions and that feature called local texture feature.

1) **LBP**

LBP represent the description of pixel vicinity image in the binary form. Basic LBP operator uses eight pixels of vicinity, accepting the central pixel as a threshold (see Figure 2.1). Pixels with the values, higher than the central one (or equal to it), accept the value <1>, those which are lower than the central one, accept the value of <0>. Thus, we get the eight-bit binary code, which describes the pixel vicinity [1].Using central pixel as threshold neighboring pixels with higher than or equal to central represent 1 and other pixels represent 0.

22	30	22
29	33	69
36	48	51

Threshold = 33 →

0	0	0
0		1
1	1	1

Binary: 00011110 Decimal :30

Using circular neighborhoods and bilinear interpolating the pixel values allow any radius R and number of pixels P in the neighborhood. Certain binary codes contain more information than others. A Local Binary Pattern is called uniform if it contains at most two bitwise transitions from 0 to 1 or vice versa.

Uniform LBP determine only important local textures primitives. LBP represent pixel vicinity image in the binary form.

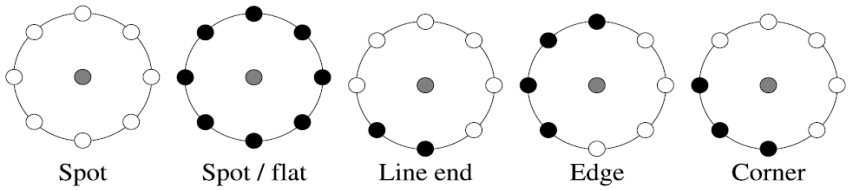

Fig2: Texture primitive detected by LBP

2) CLGW

Gabor wavelet is used to represent texture feature. In the one-dimensional case, the Gabor function consists of a complex exponential (a cosine or sine function, in real case) localized around x = 0 by the envelope with a Gaussian window shape. In a two-dimensional case, the absolute square of the correlation between an image and a two-dimensional Gabor function provides the spectral energy density concentrated around a given position and frequency in a certain direction. A Gabor filter is used with different frequency and different orientations. For feature Calculation Fourier transformation along with wavelet transformation is used.

C. Combination and Dimensionality Reduction

Local texture features from each spectral images combines in order to form a unique features representing color face image. All features value that are calculated by LBP and CLGW vectors are linearly combined here to form more informative vector of image.

For dimensionality reduction PCA technique is used. It is applied in order to reduce its number of dimensions and to select the most important components which are used as the unique feature vector representing a face image. To reduce the complexity of the featured image dimensionality reduction method are used to select most important information from it.

D. Classification

It is the last step to recognize actual face image using nearest distance technique. For classification two sets are used.

1) Training set 2) Test set

Using this two sets classifier gives four results and according to that final face identification is done.

1. True + 2. True – 3. False + 4. False -

IV. EXPERIMENTAL RESULT

Using CMU-PIE dataset create two sets of images i.e Training set and Test set. Each set select 10 images of each 10 persons from dataset. Select input image from test set and process it step by step. Proposed system gives better result than existing technique. First inputed RGB image converted into HSV and separate into different channels.

Fig3:RGB to HSV color conversion

LBP and Gabor Feature extracted from H-channel S- channel and V- channel. And channelwise combine extracted feature from both methods.

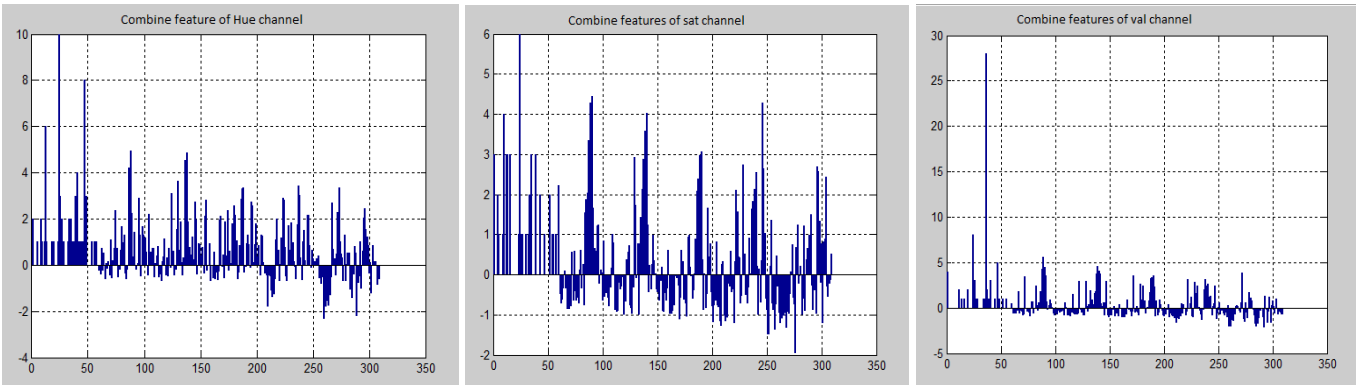

Fig4: Combine features for H-channel, S-channel and V-channel

Analytical result of proposed method with existing methods by doing same process on image. Using CCF technique of existing system and combination of LBP and CLGW technique of proposed system.

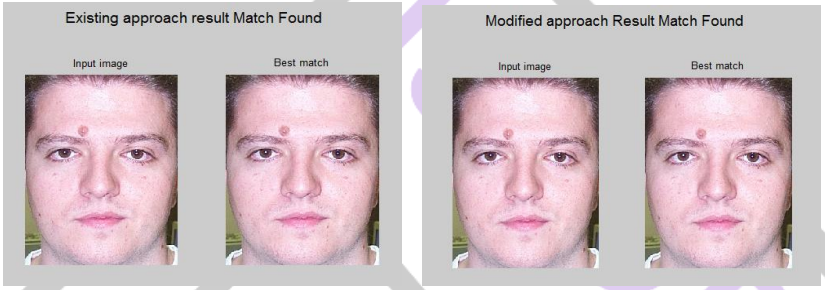

Fig5: face recognition of color image using existing technique and proposed technique.

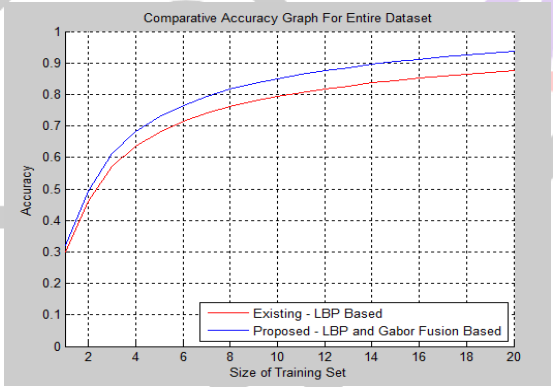

Fig6: Comparative result analysis of both techniques showing accuracy

V. CONCLUSION

Face Recognition under the different lighting conditions and poses are the major challenges. In this paper we discussed different approaches for detecting the face image, extraction of required features and recognition of face. Face recognition has become one of the important application in the recent years as it will allow the unique identification of the human face without machine contact and it also provides more recognition accuracy than other methods like palm print, finger print etc. Color information and texture feature are useful factors in image recognition. Combination of both LBP features and Gabor wavelet features improves accuracy of the face recognition. Face recognition can be practiced either on the video or the still images. In this paper more efficient technique are developed to enhance the results. Proposed method increases accuracy of face recognition upto 5 to 7%.

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