Abstract— The problem in 2D face verification system is poor illumination condition which causes variation in facial image and degrades the performance of system, in such cases this system is a reliable solution for time crucial, high volume traffic locations that require tightened security, for instance airports, border checkpoints etc. Therefore, in this paper first of all we will use IRM (Illumination Reflection Model) to detach illumination and reflectance components and then secondly we will perform Discrete Wavelet Transform (DWT) and inverse of DWT (iDWT) on the image and then finally we will be doing the fusion of wavelet image (wIIm) obtained from DWT and Wavelet Local Binary Patterns Image (wLBPIm) obtained after applying LBP in order to enhance the quality of the image and get the preprocessed image which ultimately decides whether the user is authenticated to access a particular system or not.

Keywords— Wavelet Invariant, LBP, Fusion, Micropatterns.

I. INTRODUCTION

This project mainly deals with improving the performance of face detection security system by removing the two most important factors that is illumination and reflectance which hamper detection or reorganization. Illumination deals with the geometric properties of the objects such as amount of light falling on the object from a particular source and reflectance contains information about object of scene such as edges, spots, flat areas etc. For this we are going to deal three different modules namely:

I.I Illumination Reflectance Model (IRM)

Where, IRM deals with calculating and removing two important factors that is illumination and reflectance. Here, Face image

I(X,Y)=(Reflectance R(X,Y)*Luminance L(X,Y)).

But it is difficult to calculate reflectance and illumination components from real image therefore we make assumption.

I.II Facial image in wavelet domain

In this case we use WT which is a multi-resolution image decomposition tool. It also provides good frequency resolution for low and high frequency and 2D DWT is used to detach image into four components(cAj, cDjvertical, cDjhorizontal, cDjdiagonal) without losing useful image information.

I.III Wavelet Local Binary Pattern Fusion(WL Fuse)

I.III.I Wavelet Invariant

In this case the unwanted illumination that occupies in the low spatial frequency is removed using 2D DWT. The reflectance and illumination components are separated by multi-level DWT with a suitable wavelet filter, reconstruction is then applied by Inverse DWT (IDWT) to get the wIIm image.

I.III.II Local Binary Pattern Histogram

Its purpose is to enhance the local features of wIIm such as edges, spots and flat areas. The resultant image contains the LBP histogram, which encodes the micro-patterns over the whole image. This processed image is called as wLBPIm. Overall we can say that LBP extracts local important features of image, convert it into histogram values and store these values in matrix.
I.III.III Wavelet Fusion

Fuse both wlm obtained from DWT and wLBPim obtained from LBP to complement the weakness of both sides. Then the image got after fusion is the actual pre-processed image.

Section II. Literature Survey, explains that if we consider recognition of face, face recognition is a discrimination problem of subject of interest (face image) with other subject.

Section III. Illumination Reflectance Model(IRM), which detaches the illumination and reflectance components.

Section IV. Facial image in wavelet domain, which decomposes the image into it’s components for resolution purpose.

Section V. Wavelet Local Binary Pattern Fusion(WL Fuse). It consists three sub modules as Wavelet Invariant: To get wlm Image, Local Binary Pattern Histogram :To get wLBPIm Image and Wavelet Fusion: To fuse both wlm and wLBPIm to get pre processed image

Section VI. Result discussion and conclusions.

II. LITERATURE SURVEY:

All image formats gone through here use an image transform, quantization and coding. Transforms can be separable extended to two dimensions for applications to image processing. Therefore, we state our results in one dimension only for the sake of simplicity. In our security-heightened world, biometric facial image emerges as a popular biometric recognition technique for real-time facial image acquisition without intrusive or detaining subjects. A brief review of related literatures on preprocessing-based illumination invariant techniques is provided.

From recognition point of view, face recognition is a discrimination problem of subject of interest (face image) with other subject. It is fundamentally a two-class classification task. For the purpose of attaining higher recognition performance, it is desirable to reduce the variation of subject within class, which is known as intra-class variation, and increase the variation of subject between classes, which is named as inter-class variation.

Poor illumination condition is recognized as one of the major problem in contemporary two dimensional (2D) face verification system. It causes large variation in facial images and degrades the performance of the system[1].

In our project a facial image illumination invariant technique is devised based on the fusion of wavelet analysis and local binary patterns. Particularly, illumination–reflectance model is used to detach illumination and reflectance components with multi-resolution nature of wavelet analysis[1].

III. ILLUMINATION REFLECTANCE MODEL:

Where, IRM deals with calculating and removing two important factors that is illumination and reflectance. Here, Face image I(X,Y)=(Reflectance R(X,Y)*Luminance L(X,Y)). The reflectance component consists of information about the structure or edges of image and illumination component consists of geometric properties like light falling on objects due to light source.

But it is difficult to calculate reflectance and illumination components from real image therefore we make assumption.

IV. FACIAL IMAGE IN WAVELET DOMAIN :

In this case we use WT which is a multi-resolution image decomposition tool. It offers a variety of channels representing image features in different frequency subbands at multiscale. It also provides good frequency resolution for low and high frequency and 2D DWT is used to detach image into four components(cAj, cDjvertical, cDjhorizontal, cDjdiagonal) without losing useful image information.

It can be used to perform 2D wavelet transform of a facial with one level,two level,three level decompositions and so on.

GUI frame :

Firstly we created a GUI containing Browse option that selects a particular image from the image list. Frame having tabs namely “perform wavelet analysis”, “perform LBP(local binary pattern)”, “perform Fusion(using AFUSMETH and DFUSMETH)”
Discrete wavelet transform (DWT):

Steps

1. First we will be selecting an image from the image list and converting it from RGB to Grey.
2. Then we will be converting it into pixels.
3. These pixels are then stored into a 2D array consisting of height and width of the image.
4. Then we find the minimum and maximum values of the pixels, on which DWT is applied which detach image into four components without losing useful image information as shown in Fig 1.

Fig. 1 DWT Components

V. WAVELET LOCAL BINARY PATTERN FUSION (WL FUSE):

In this case, we try to fuse the two images namely wavelet image (wIm) obtained after applying DWT and iDWT respectively and wavelet local binary pattern image (wLBPim) obtained by applying LBP histogram as shown in Fig 2.

Fig. 2 Fusion

LBP Histogram:

In LBP first of all we divide facial image into local regions. Then the local feature descriptors are extracted from each region independently. The descriptors are then concatenated to form global description of the face as shown in Fig 3.

Fig. 3: Image Histogram
VI. SNAPSHOT OF OUR PROJECT:

Fig 4. DWT frame

Fig 5. Image to be processed

Fig 6. DWT component

Fig 7. LBP Histogram
Fig 10 is used as an input to the system. The output of the system is as follows:

|0,0,0,1,0,0,0,1|
|0,1,0,1,1,0,0,1|
|0,0,0,1,1,1,0,0|
|0,0,1,2,2,1,0,1|
|1,1,0,2,1,0,0,1|
|0,0,1,2,2,2,0,0|

Match: true

BUILD SUCCESSFUL (total time: 2 seconds)

CONCLUSION AND FUTURE SCOPE:

Thus for the improvement of performance of the security systems using face detection, it is very important to remove the two most important factors that is illumination and reflectance which hamper detection or reorganization.

There is still some future scope for this paper such as this paper refers to only 2D face verification but it can be implemented for 3D also.

And here we are dealing with only already stored images but it can be implemented for real time images.

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