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## FACE AND THUMB RECOGNITION BY IMAGE FUSION AND STEGO IMAGE USING DWT AND LSB TECHNIQUE

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**Abstract-** Image Fusion is a method of combining the relevant information from a set of images, into a single image, where in the resultant fused image will be more informative and complete than any of the input images. For multi-focus image fusion as it is related to frequency distortion the wavelet with symmetric property is more useful to retrieve the image. Hence, to select the wavelet family, which provides better frequency resolution is important. It has been found that the standard fusion methods perform well spatially but usually introduce spectral distortion. To overcome this problem, numerous multi-scale transform based fusion schemes have been proposed. This paper presents two approaches to image fusion, namely Spatial Fusion and Transform Fusion and describes Techniques such as Principal Component Analysis which is spatial domain technique and Discrete Wavelet Transform which is Transform domain technique. In this paper, the focus is on the biometric and science, fusion method based on the discrete wavelet transform (DWT), the most popular tool for image processing. Again in addition here one more concept is used i.e. hidden secret key inside the fused image using LSB substitution. This will make the biometric systems more secure.

**Keywords-** Discrete Wavelet Transform, Image Fusion, PCA, LSB.

### I. INTRODUCTION

Biometrics is the science and technology of measuring and analyzing biological data of human body. Multimodal biometrics perform more accurate than the uni-modal. In this paper we use face and thumb images for recognition. In addition with the aim to recognize face and thumb images secret key

matching concept is also introduced. Image fusion means in general and significant extraction of information acquired in several domains. The goal of image fusion (IF) is to integrate complementary multi-sensor, multi-temporal and/or multi-view information into one new image containing information the quality of which cannot be achieved otherwise. The term quality, its meaning and measurement depend on the particular application. There are two groups into which image fusion methods are divided, namely spatial domain fusion method and Transform domain fusion method. Spatial domain fusion method will directly deal with pixels of input images. In Transform domain fusion method image is first transformed into frequency domain.

### II. BACKGROUND

Experimental analysis shows that Uni-modal biometric systems had many disadvantages regarding performance and accuracy. Multimodal biometrics systems perform better than Uni-modal biometrics systems and are popular. From the past decade, researchers have proposed well recognition methods using various hand traits as finger print, palm print, hand geometry, face geometry etc. Considering all these analysis here we will implement the fusion of finger and face images with hidden secret key. The result of fusion will be represented by using graphical user interface. Here since the secret key will be hidden inside the fused image the system will be more secure than the simple fusion of two fingerprint images or face and thumb images. In the proposed work, the quality of image will be evaluated using different parameters. Sulthana et al [2014], "A Review on Fusion techniques for fingerprint recognition". This paper describes some of the fusion techniques for fingerprint recognition. The comparison of all levels of image fusion using

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MSVD, DWT, DSWT and DTCWT in terms of various performance. Dr. Daniel Madan Raja S et al [2014], Information Technology BIT, Erode, India "Human Face Recognition under varying illumination Condition Using Wavelet Transform", proposed DWT for the human facial recognition under illumination conditions. Third-level wavelet decomposition is applied with db 4 for all the dataset collected. Once the preprocessing and feature extraction are done, the main role of image processing begins as a classifier.

K. Usha Researcher Scholer et al [2014], "Haar-Wavelet transform based finger Knuckle Print recognition" This method proposed mainly for pattern recognition and image processing using haar-wavelet due to their wavelet like structure. This HWT based algorithm is capable of working on low dimensional feature space.

Mr. Rajendra Pandit Desale et al [2013], "Study and Analysis of PCA, DCT and DWT based image fusion techniques", analyzed the PCA and DCT are conventional fusion techniques with many drawbacks whereas DWT based technique provides a better result for image fusion.

Devaki et al [2014], "A Novel Algorithm to Protect the Secret Image through Image Fusion and Verifying the Dealer and the Secret Image", proposed The secret image will be fused with the fingerprint of the dealer for authentication purpose. Fusion of the finger print will be done by using image fusion technique to generate a single image consisting of the secret image as well as the finger print image of the dealer. The fused image will be divided into number of shares based on the threshold secret sharing technique. This provides both confidentiality of the secret image and as well as the authentication of the dealer who has sent the image. The verification will be done during reconstruction of the secret image.

D. Maltóni, "Handbook of fingerprint Recognition," 2<sup>nd</sup> Edition, Springer-Verlag, 2009 gives us all biometrics recognition schemes such as fingerprint, face etc.

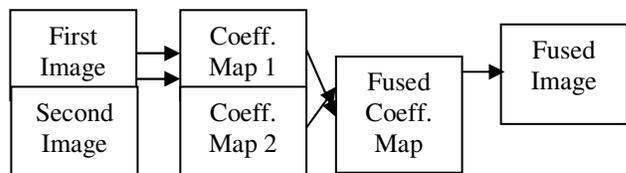
**III. WAVELET TRANSFORM:**

Wavelet theory is an extension of Fourier theory in many aspects and it is introduced as an alternative to the short-time Fourier transform (STFT). In Fourier theory, the signal is decomposed into sines and cosines but in wavelets the signal is projected on a set of wavelet functions. Fourier transform would provide good resolution in frequency domain and wavelet would provide good resolution in both time

and frequency domains. Although the wavelet theory was introduced as a mathematical tool in 1980s, it has been extensively used in image processing that provides a multi-resolution decomposition of an image in a bi-orthogonal basis and results in a non-redundant image representation. The basis are called wavelets and these are functions generated by translation and dilation of mother wavelet. In Fourier analysis the signal is decomposed into sine waves of different frequencies. In wavelet analysis the signal is decomposed into scaled (dilated or expanded) and shifted (translated) versions of the chosen mother wavelet or function. A wavelet as its name implies is a small wave that grows and decays essentially in a limited time period.

**IV. IMAGE FUSION USING DWT**

Discrete wavelet transform decomposes the image into low-high, high-low, high-high spatial frequency bands at different scales and the low-low band at the coarsest scale. The L-L band contains the average image information whereas the other bands contain directional information due to spatial orientation. Higher absolute values of wavelet coefficients in the high bands correspond to salient features such as edges or lines. Since larger absolute transform coefficients correspond to sharper brightness changes, a good integration rule is to select, at every point in the transform domain, the coefficients whose absolute values are higher. The common element idea in almost all of them is the use of wavelet transform to decompose images into a multi-resolution scheme. Then, with some specific rules of decision or weighting, the images are combined into a single fused one.



**V. PROPOSED METHOD**

Proposed method has mainly has two levels of authentication. Level one has five stages as, preprocessing, wavelet transform, fusion, feature extraction and classification. If level one will

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complete then level two will be executed. In second level there are two modules hiding technique (Least Significant Bit), extracting the secret key using reverse LSB process. Proposed method block diagram is shown in Fig.1 and its explanation is as follows:

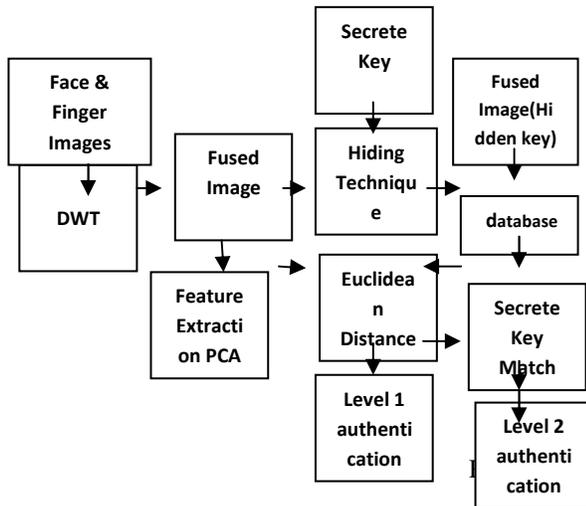


Fig.1 Building blocks of multimodal face and thumb recognition including hidden secret key

Flow of the block diagram is explained below:

1. Input images are of face and thumb.
2. Images are preprocessed by resizing, enhancing and filtering.
3. Decomposition of image using DWT
4. High and low frequency components are fused by maxima selection rule.
5. Inverse DWT is applied on fused image
6. Features are extracted using PCA
7. Same process is carry out on database images and extracted features are stored in memory
8. Apply Euclidean distance for comparison purpose (i.e. for comparing test image and database image feature).
9. If the test image features are match with database image features then person is authentic otherwise unauthentic
10. If the person is unauthentic then the authentication will not provided to the person but if the person is authentic then

Only level one authentication will be provided to that person and system will ask for the secret key for providing the complete authentication (i.e. access of the biometric system).

11. The secret key given by the user will be hidden inside the fused image using LSB (Simple least significant bit) technique and while testing the reverse LSB process will be applied on Database image to extract the hidden key.

12. If the extracted key will be matched to the key which is given by the person then complete authentication of the system will be provided to the person.

**VI.FEATURE EXTRACTION USING PCA**

Feature extraction captures the detailed information about the images which form the basis of recognition system and reduces the image dimension by representing them in the form of feature vectors. Principal Component Analysis is a feature extraction technique that extracts global features from the images. This is an oldest method which computes Eigen values and generates Eigen vectors for extracting the features of the corresponding input. The steps involved in PCA are as follows:

- a) Represent all the 2D images in the database as a 1D row or column vector in the form of matrix
- b) Average across each dimension is calculated that gives the mean.
- c) Mean vector is subtracted from each dimension to give a zero mean dataset.
- d) Compute the Eigen vector and Eigen values.
- e) Choose the first few Eigen vectors corresponding to maximum Eigen values.
- f) Eigen vectors represent a pattern in an image which forms the principal component.
- g) The final feature vector is obtained by multiplying the Eigen vector with mean subtracted image.

**VII.EUCLIDEAN DISTANCE**

The Euclidean distance is the nearest mean classifier which is commonly used for decision rule is denoted as

$$d(x, w) = (x - w) + (x - w)$$

Where the claimed client is accepted if  $d(x, w)$  is below the threshold and rejected otherwise.

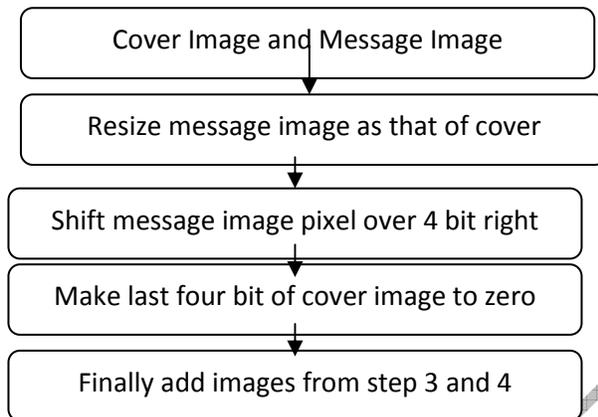
**VIII.SIMPLE LSB TECHNIQUE**

Data hiding is a method of hiding secret messages into a cover-media such that an unplanned observer

will not be aware of the existence of the hidden messages. One of the common techniques is based on

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manipulating the least-significant-bit (LSB) planes by directly replacing the LSBs of the cover-image with the message bits. LSB methods typically achieve high capacity. It replaces the LSB of each pixel with the encrypted message bit stream. Authenticated receivers can extract the message by decrypting the LSB of every pixel of the host image with a pre-shared key. The procedures used in the LSB method are:



In order to recover the secret image/ Key at the receiver's side the pixel of the image that is shifted left at the LSB process should be shifted right. The procedures are:

- 1) Get the retrieved image/key as input.
- 2) Shift the message image/key pixel values over four bits to the left.
- 3) Message image/Key is obtained

Now a days there are various types of biometrics systems are available for recognition. Biometrics uses uni-modal and multimodal security systems for fusion. Here we take face and thumb images for testing and training purpose. Again the DWT provides very good results both quantitatively and qualitatively. In addition with the fusion Least Significant Bit technique is used for hiding secret key inside the fused image which will increase the level of security.

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