

Face Recognition by Fusion of DWT and FFT

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Abstract— In this project we propose efficient face recognition using fusion of DWT and FFT methods. Face recognition is a widespread identification technique because of high confidence rates. Here comparison of DWT, FFT and FUSION techniques take place. DWT gives only magnitude values. And FFT gives both magnitude and phase values. But in this proposed system concentrates both TSR and EER values. So here we are using fusion technique called “mathematical analysis” based on TSR and EER values. And need to get high TSR value and low EER value with high accuracy and low execution time.

Key words: DWT, FFT, TSR, FAR, FRR, EER, PCA, Image Processing

recognition has a mellow degree of precision; however, they require the subject to follow with the recognition process. Face recognition can be executed with a small degree of abundance, meaning that people can be named without their accept or even their cognition. Face identification is a part of pattern recognition in applied science. Face recognition for human beings are especially good. Because of high security means without knowing the person knowledge can take a photo of an individual. The system consists of three tasks. Namely acquisition, normalization and identification. The meaning of acquisition is the sensing and trailing of face images in a active shot. Normalization is also same as segmentation, alignment of the facial images, and identification is representation of face images.

I. INTRODUCTION

The word Biometry is obtained from Greek, meaning of ‘bios’ is life and ‘metrikos’ is to measure. Personal recognition of an individual can be done by using a wide range of pattern recognition systems, there by individuality of a person who is calling for their services can be viewed. The main responsibility of these strategies is to ensure that the helps are accessed by a valid exploiter. Biometrics cannot be forgotten, stolen, borrowed and forging can never be done. Applications of biometrics include secure access to laptops, entry to premises, ATM, cell phones. Biometrics denotes to the identification of individuals depending on their behavioral or physiologic features. Based on the body characteristics such as face, eye, voice, etc., human recognizes each other. Human Behavior and physical characteristics can be used as basis of biometrics.

II. RELATED WORK

Facial recognition is a noninvertible system, and to build a personal identification, human uses facial images. In face recognition the person can be identified or verified from a digital image that is captured by a computer application. The facial feature from the digital image will be compared to the one which is in database. The computer algorithm analyses the shape of jaw, lips, cheekbones, eyes and then it searches for the image that have similar feature in the pop advances to face identification are :

- 1) Face characteristics means facial assigns such as nose, qin, brows etc. between those distances extraction of feature take place, or
- 2) The overall analytical thinking of the face that constitutes a face as a weighted combining of a number of basic faces.

Facial identification system work well mechanically the following methods:

- Notice a face is there in the developed image
- If there is one, situate the face
- Identify the face image from a universal outlook

Face recognition has been the capable of intense interest in recent years. Biometry such as finger print or iris

III. PROPOSED SYSTEM

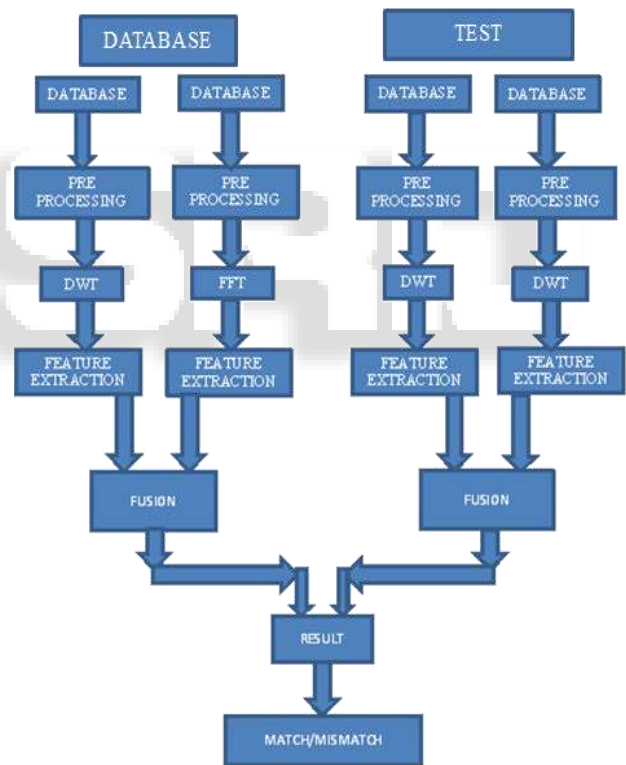


Fig. 1: Block diagram of proposed system

A. Face Databases

The biometric data samples of face are collected from standard database such as NIR, ORL, COMBINED, JAFEE and YALE

1) ORL Database:

This database consists total 40 persons and each person having 10 images. And the input database created with 34 persons in total 40 persons. So the database contains total 50 images. And select any person in those 340 images, using this database to compute FRR and TSR. Remaining 6 persons out of 40 persons consider calculating FAR



Fig. 2: ORL face images of persons

B. Pre-Processing

The principal object of pre-processing is to obtain a translated image with enhanced quality of the colour image is changed into gray scale images. The original size of Face images are re-sized to the expected sizes

It includes

1) Noise Remotion

The input data base contains noise elements or attributes, in order to remove those noises Gaussian filter is used. Because don't know which noise occurred. Gaussian filter mainly used to remove Gaussian noise.

2) Smoothing

After removing noise, some data will lost so we have to resize that noise output

3) Thinning and Thresholding

At the time of resizing the database the quality of that database is low. In order to get good quality thinning is used. In thresholding approximate the edges in the database.

C. Feature extraction

1) Discrete Wavelet Transform

The wavelet transform is widely applied in the field of compression of graphics or images to store or transmission, image denoising and in signal processing. In Wavelet transform signal is broke down to form a mate of basic functions. Wavelets are nothing but these basis functions. By shifting and dilation sue wavelets come into possession from mother wavelet, which is a single prototype wavelet. For breaking down a signal into sub bands DWT is believed as highly flexible and effective technique. In image processing nowadays 2D-DWT is accepted as a crucial operation. It will break down the images into scaling functions and wavelet coefficients and it is a multi-resolution analysis. In Discrete Wavelet Transform, the energy of the signal concentrates to particular wavelet coefficients. This boast of DWT is assistive for image compression. The image is converted into series of wavelets. This changeover is done by wavelets. And these series of wavelets can be stored more expeditiously than pels blocks.

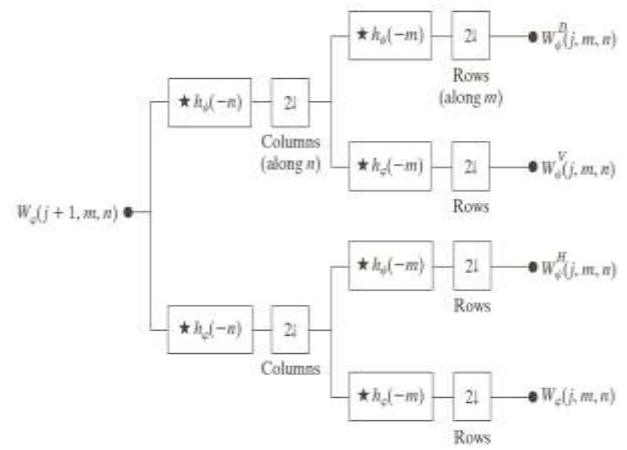


Fig. 3: Image decomposition into four sub bands using 2-D DWT

2) Fast Fourier Transform

The FFT is implemented on spatial domain image to get FFT coefficients. FFT is fast calculation compared to Discrete Wavelet Transform. FFT categorized as both decimation in frequency and decimation in time.

a) Decimation-In-Time

Make use of both symmetry and periodicity. In the case of N, an integer power of 2 Separate $x[n]$ into two sequence of length $N/2$

$$X[k] = \sum_{n=0}^{N-1} x[n]e^{-j(2\pi/N)kn} = \sum_{n \text{ even}}^{N-1} x[n]e^{-j(2\pi/N)kn} + \sum_{n \text{ odd}}^{N-1} x[n]e^{-j(2\pi/N)kn}$$

Below fig shows 8-point DFT example using decimation-in-time contains Two $N/2$ -point DFTs in that

- $2(N/2)^2$ complex multiplications
- $2(N/2)^2$ complex additions

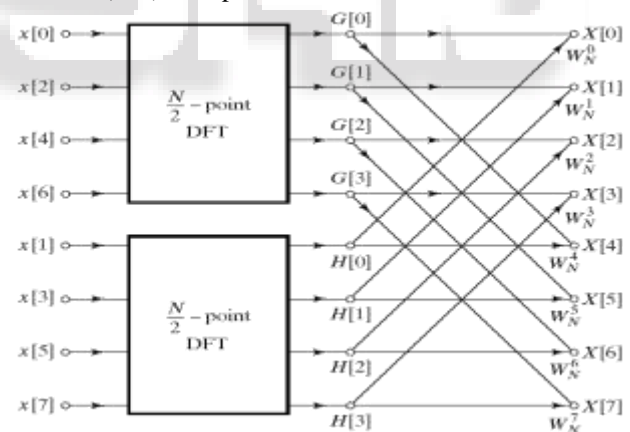


Fig. 4: Point DFT using decimation in time

D. Fusion Technique

In fusion technique we are going to fuse DWT and FFT coefficients. DWT output give LL band output. And FFT output gives FFT coefficients. Both outputs are fused to get TSR and EER. We fuse the matching score i.e. TSR obtained from fusion of DWT and FFT features with the matching score obtained from Log Gabor features by using the following formula.

There are many fusion techniques such as maximum, minimum, average and mathematical analysis. Here we are using mathematical technique because we concentrate on both TSR and EER. So in order to get High TSR and Low EER using mathematical analysis. Final score, $F = X * C + (1-X) * D$

Where,
X is improved factor that ranges from 0 to 1

E. Matching Section

Matching is done using Pairwise distance (Pdist). It computes the Euclidean distance between pairs of points in data matrix. There are many matching techniques are there such as hamming distance, here we are going to use Euclidian distance technique because it operate both block – white and colour images. Here comparison of pixel takes place in pairwise of both enrolment and test section. If it is matched means our system holds good.

$$d1(p,q) = \sqrt{\frac{1}{M} \sum_{i=1}^M (p_i - q_i)^2}$$

Where,
M = the dimension of feature vector.
Pi = is the database feature vector.
qi = is the test feature vector.

IV. RESULTS AND SCHEMATIC OUTPUTS

A. Input Data

Data given below are the inputs for different data bases to obtain EER and TSR values.

	ORL	JAFEE	COMBINED
NOP	34	07	20
NOIP	06	08	08
Upper limit	40	10	30

Table 1: inputs for different databases

NOP - Number of Person
NOIP - Number of Images per Person

B. Fusion output for different databases

	THRESHOLD	EER	OPT TSR	MAX TSR
ORL	0.6	0.2	70	93.3
JAFEE	0.55	0.0	100	100
COMBINED	0.5	0.0	100	100

Table 2: FUSION outputs for different databases

EER - Equal Error Rate
OPT TSR - Optimized Total Success Rate

C. Comparison of DWT, FFT and fusion output for ORL database

DWT - Discrete Wavelet Transform
FFT - Fast Fourier Transform
EER - Equal Error Rate
OPT TSR - Optimized Total Success Rate
MAX TSR - Maximum Total Success Rate

DWT			FFT			FUSION		
EE	OP	MA	EE	OP	MA	EE	OP	MA
R	T	X	R	T	X	R	T	X
	TS	TS		TS	TS		TS	TS
	R	R		R	R		R	R
0.47	60	85.2	0.3	70	91.5	0.2	70	93.3
5		9	0					3

Table 3: comparison of transfer domain techniques using ORL data base

Here, comparing Transform domain techniques DWT, FFT and FUSION. According to the TSR output FUSION is Better Compared to DWT and FFT.

D. Face Recognition by Discrete Wavelet Transform for ORL database

1) Output: False Acceptance Ratio (FAR) and False Rejection Ratio (FRR),(EER output)

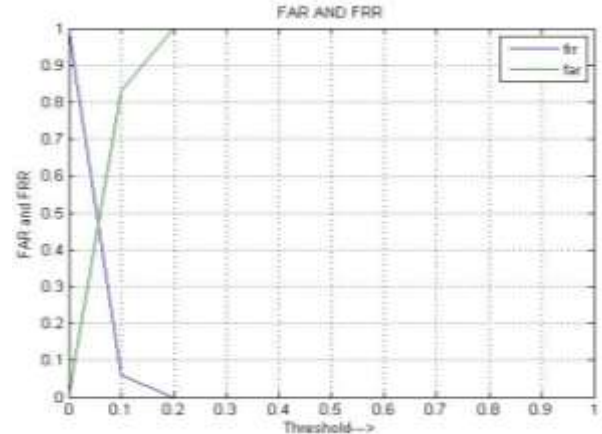


Fig. 5: EER output for ORL database of DWT

2) Output: Total Success Rate

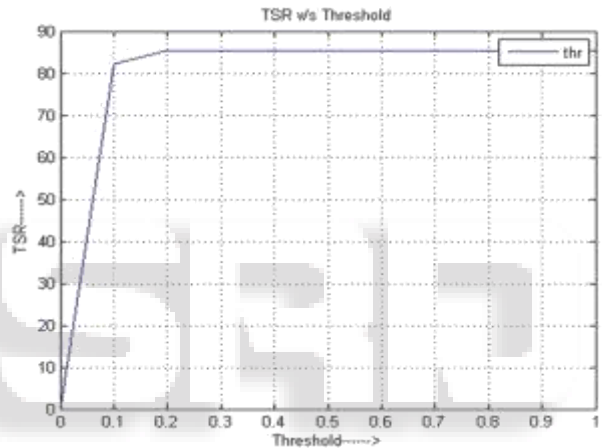


Fig. 6: TSR output for ORL database of DWT

E. Face Recognition by Fast Fourier Transform for ORL database

Output: False Acceptance Ratio (FAR) and False Rejection Ratio (FRR)

1) (EER output)

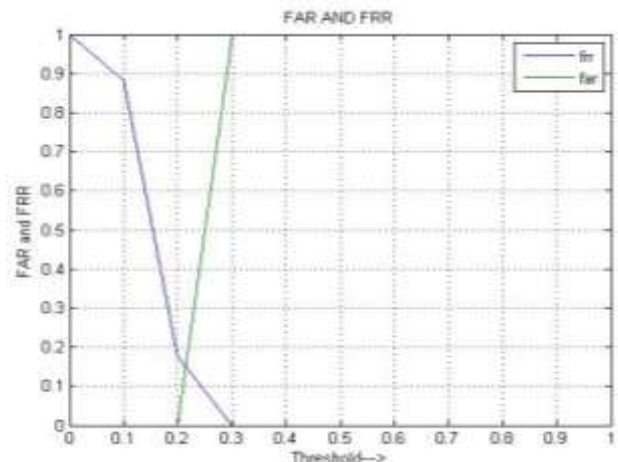


Fig. 7: EER output for ORL database of FFT

2) Output: Total Success Rate

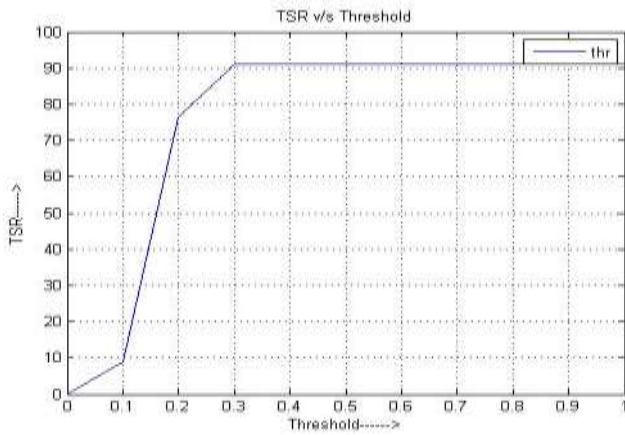


Fig. 8: TSR output for ORL database of FFT

F. Face Recognition by FUSION Technique for ORL database

1) Output: False Acceptance Ratio (FAR) and False Rejection Ratio (FRR), (EER output)

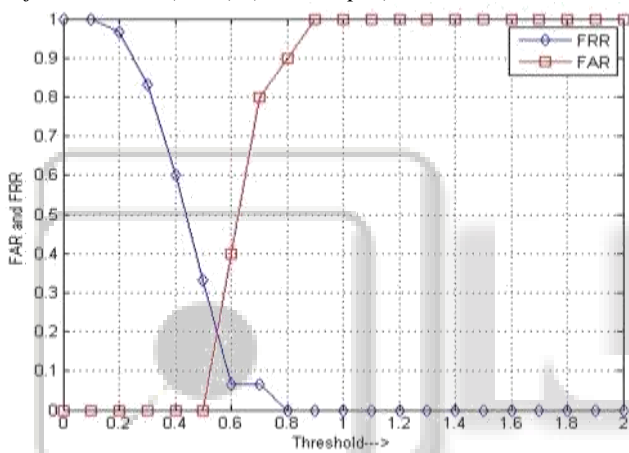


Fig. 9: EER output for ORL database of FUSION

2) Output: Total Success Rate

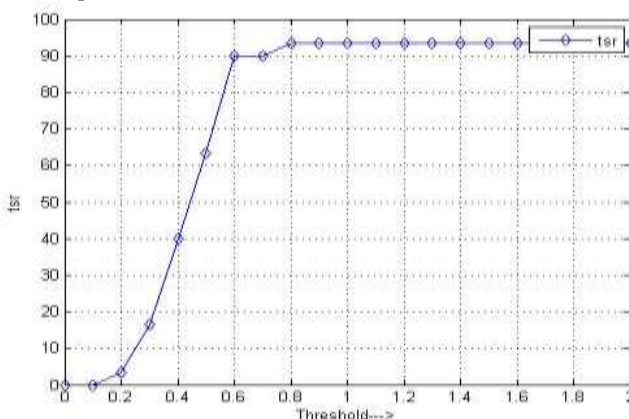


Fig. 10: TSR output for ORL database of FUSION

V. CONCLUSION

Transform domain technique are better compare to spatial domain where frequency information place a major role to identify face images.different databases taken as a input data they have large feature oriented. and we use DWT for magnitude frequency information and FFT for phase information.DWT gives LL band output and FFT gives FFT

coefficients.but we need more accuracy and security so here we fuse both DWT and FFT coefficients.and also got high TSR value and low EER value by using fusion technique.

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