Face Recognition using Wavelet Transform

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ABSTRACT
Face recognition is promising as an active research area spanning several disciplines such as computer vision, pattern-recognition, neural network and image processing. It plays an-important role in many application areas such as authentication, human machine and surveillance.

Human beings appear to recognize faces in cluttered scenes with relative ease having the ability to identify coarsely quantized images, distorted images and face with occluded details. Machine recognition is much more a discouraging task. Understanding the human mechanisms employed to recognize face constitutes a test for psychologists and neural scientists. Additionally to the cognitive aspects, understanding face recognition is important since the same underlying mechanisms could be used to make a system for the automatic identification of faces by machine.

This paper presents face recognition using discrete wavelet transform (haar), wavelet filters have been implemented as a part of the proposed algorithms due to their simplicity, regularity and suitability for face recognition, and minimum distance is used to matching image with data base stored by Microsoft Access which is connected with csharp language to programming.

Keywords
Face Recognition,Wavelet, Haar transform, DWT(discreet wavelet transform) .

1. INTRODUCTION
Face recognition provides an acceptable solution to the problem of current perceived world security situation, government as well as businesses require reliable methods to accurately identify individuals without overly infringing on rights to privacy or requiring significant compliance on the part of the individual being recognized. [1]

Feature extraction is realized during some linear or nonlinear transform with subsequent feature selection for reducing the dimensionality of facial image so that the extracted feature is as characteristic as possible [2]. Face recognition from image is a demanding task because of variable factors like occulting scale pose, alteration in location, facial and all appearance of the face [1,3].

Wavelet transform has been successfully used in image processing, its capacity to capture localize time frequency information of image motivates, its use for taking out the feature, the decompose of the date in to different frequency ranges allows us to detach the frequency components introduced by intrinsic deformation because of expression or extrinsic factors into certain subband wavelet is a methods prune away these variable subbands and focus on the sub bands that most relevant information to better represent the data [2,3].

2. WAVELET TRANSFORMS
The advantage of wavelet transform above Fourier transforms is temporal resolution. Wavelet transform captures both time and frequency i.e. information location . The DWT has a- vast number of applications in science, computer science, engineering and mathematics. The Haar transformation is used here for simplistic of all wavelet transformation and can successfully provide our purpose. Wavelet transform has qualities of multi-scale, multi-resolution decomposition. To get the standard decomposition of a 2D image, the 1D wavelet transform to each row is applied first , this operation gives an average pixel value along with detail coefficients for each row. Now, 1D wavelet transform to each column is applied. The resultant pixel values are all detail coefficients except for a single overall average coefficient. As a result the oval shape facial image is decomposed, and then four regions can be gained. These regions are one low frequency LL1 (approximate component), and three high-frequency region, namely LH1 (horizontal component), HL1 (vertical component), and HH1 (diagonal component), respectively as shown in Fig.1. The low frequency sub-band LL1 can be further decomposed into four sub-bands LL2, LH2, HL2 and HH2 at the next coarse scale. LLi is a reduced resolution corresponding to the low-frequency part of an image. The sketch map of the quadratic wavelet decomposition is shown in Fig. 2.[4,**5].**

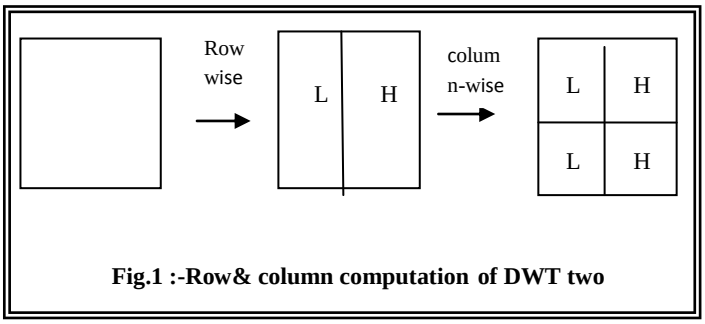


Fig.1 :-Row& column computation of DWT two

Haar wavelets are defined as:[6]

$$\boldsymbol{\psi}_{\mathbf{a,b}}(\mathbf{x}) = \mathbf{2}^{\frac{\mathbf{a}}{\mathbf{2}}}\boldsymbol{\psi}(\mathbf{2}^{\mathbf{a}}\mathbf{x} - \mathbf{b}) \ \ \mathbf{where\ b} = \mathbf{0}, \mathbf{1}, .., \mathbf{2}^{\mathbf{a}} - \mathbf{1} \ldots.(1)$$

Where $\psi(x) = \begin{cases} 1 & 0 \le x < 1/2 \\ -1 & \frac{1}{2} \le x < 1 \\ 0 & \text{otherwise} \end{cases}$ is the Haar mother wavelet

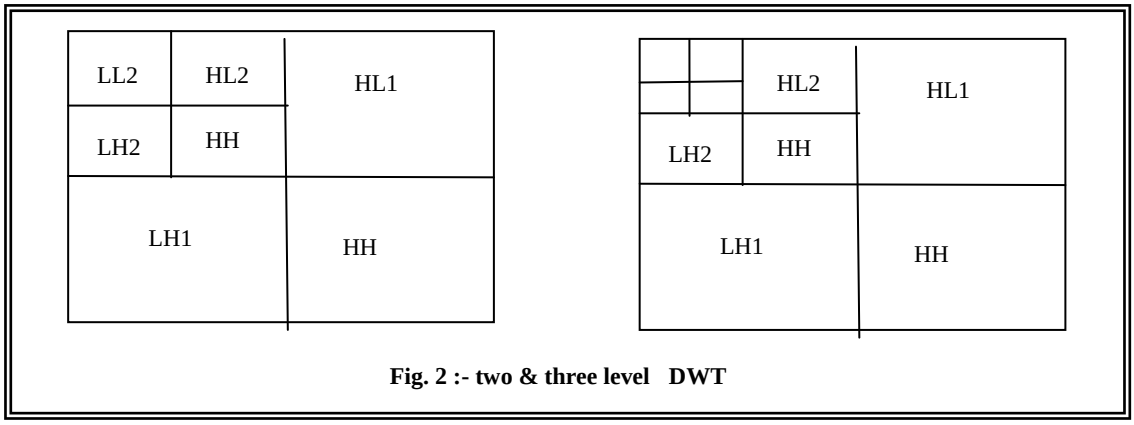


Fig. 2 :- two & three level DWT

3. ENERGY PROBABILITY

Energy is one of the image property using signal processing technique, and it instrument characteristics of images. The energy is defined as following equation [7]:

$$\text{Energy}_f = \sum_{u=1}^{n}\sum_{v=1}^{n}|f(u,v)|^2 \ldots.(2)$$

Energy is a value worried with an image and a property of each image. It cannot be fitting our purpose, 0ptimization and dimension reduction of valid information, because we want the property about available pixel information. [7,8]

4. EUCLIDEAN DISTANCE

Images of M * N are easily discussed in an MN dimensional Euclidean space, called 'image space'. It is normal to adopt the base e1,e2 ,e3,….,eMN to form a coordinate system of the image space, where ekn+1 corresponds to an perfect point source with unit concentration at location (k,l) . Thus an image =x1,x2,…,xmn , where xkn+1 is the gray level at the (k,l) th pixel, is represented as a point in the image space, and xkn+1 is the organize with respect to ekn+1 . The origin of the image space is an image whose gray levels are zero everywhere, Euclidean distance calculates the shortest Euclidean distance from clidthe query image and database image, as shown in equation (3).[9]

$$\text{ED}= \sum_{i=0}^{n-1}|fi - fri|^2 \ldots\ldots..(3)$$

Where f is feature space of database image& fr is feature space of query image.

5. PROPOSED SYSTEM

The block diagram for the proposed system is shown in figure (3).

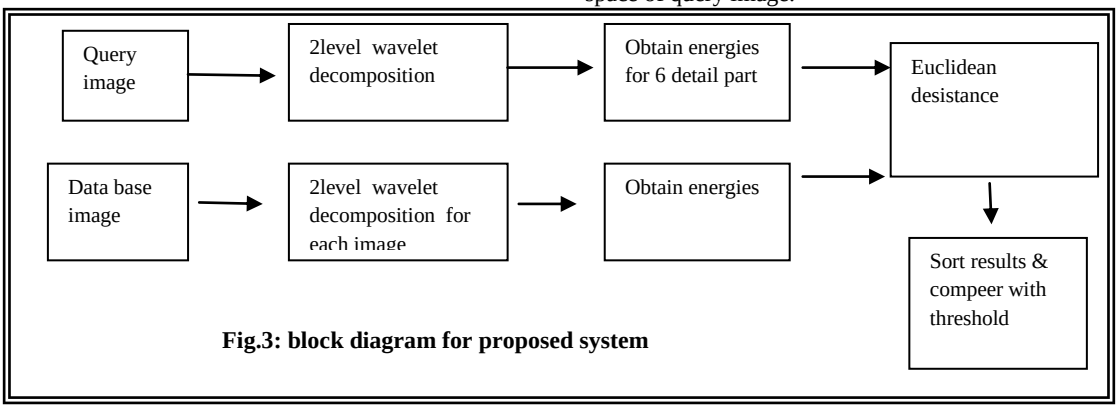


Fig.3: block diagram for proposed system

The proposed system is written with csharp programming language and contacted it with Microsoft Access to store data base which consists of 300 face images attained from 30 people every people have 10 image of different expression, and follow the algorithm bellow**:-**

Input:- Face Image file.

Output:- Weather face is found in database.

Step1:- load face image file.

Step2:- convert image to gray level.

Step3:- decompose the image by using 2D DWT with 2 levels.

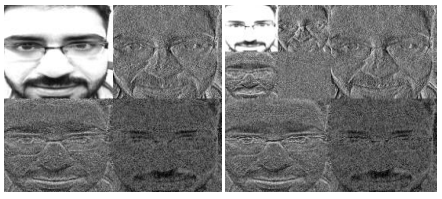
Step4:- Compute normalized energy for 6 sub-image.

Step5:- In each image in database stored compute 2D DWT and stored it with their energy (for 6 details parts).

Step6:- Euclidean distances are then used as a feature vector to perform recognition.

Step7:- Compeer with threshold.

In step 3 decompose the image by 2D DWT as shown in fig(4)



(a)1level 2D DWT (b) 2 level 2D DWT

Fig.4 1&2 level DWT

In step 7 compare the minimum distance with threshold (0.2) if less than it is found face in database and display its information if greater than appear a massage that face is not fond in database, some of database is shown in fig.5 the value of threshold is fixed to (0.2) if greater than it, the system gives valid recognition because error between feathers of the two images becames big.

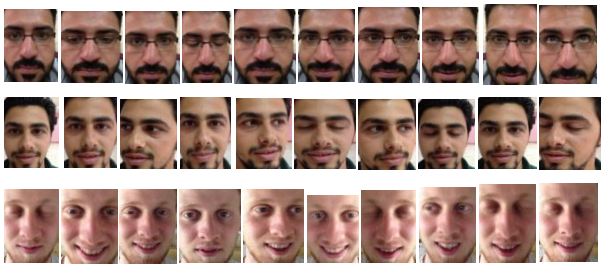


Fig (5) some of database

The aurthor chooses Haar wavelet among other wavelet family because it gives recognition rate (%) more than other wavelet family that because it is the simplest and accurate as shown in table (1) and chart(1) below:-

Table 1. Recognition results using different Wavelet Transform

Wavelet faimly	Recognition Rate (%)
Haar	90.34
Daubechies (db2)	84.12
Biorthogonal	79.31

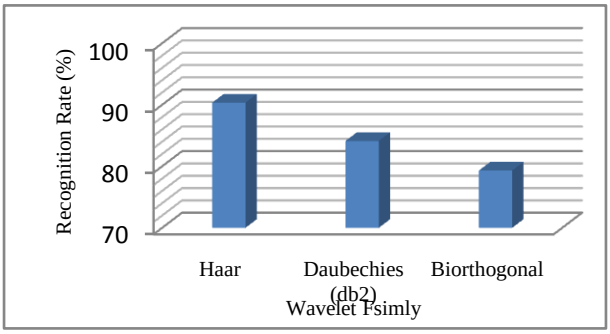


Chart (1) Recognition results using different Wavelet Transform

6. CONCLUSION

When using cshap with Microsoft Access (for database)that give the proposed system strong and dependency such that system can add, delete and update the database simply. Use Haar Wavelet Transform with 2level give better recognition result than db2 and Biorthogonal Wavelet Transform.

The author future work includes implementing the proposed algorithm with more multi-resolution transforms and finding the transform which give maximum recognition rate, the future research-orientation in the future is to design algorithm that use neural net work instead of minimum distance in recognition. In addition can use more than 2 level wavelet to extract the most feather of image.

7. ACKNOWLEDGMENTS

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8. REFERENCES

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