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IFS Code As Feature in Face Recognition System

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Abstract— In the current research an experimental study of method of face recognition that based on fractal image encoding has been carried out in details .The feature of self-similarity is utilizing to encode an image for facial image recognition by capturing intrinsic self-similarity within the image. Fractal image encoding method has some invariance to scaling, translation, rotation and luminance. Fractal image encoding method encode an image to extract the feature of the holist face and to make a decision in matching step of the system, it consists of the binary file which it includes: fractal code (IFS code sets), dimensional and parameters of the face image. Face recognition is done by get the highest Peak Signal-to-Noise Ratio (PSNR) of decoding image that resulting from the process of iterated all the IFS code that has been stored in the database multiple time and the image with the highest PSNR is recognized image .In the result part, the proposed method is applied on FEI database and the accuracy rate reached 88.1% when face image at side profile orientation are within 45 degree.

Keywords— face recognition; fractal image coding; fractal code; self-similarity; peak signal-to-noise ratio.

I. INTRODUCTION

Recognition of face is considered one of the latest biometrics methods; it utilizes the natural features to recognize any individual. It is one of present fields that attracted a great deal of concentration over last year's due to its importance in many vital sectors such as security ,surveillance field ,image database investigations identity authentication, and other domains[1], Due to the fact that the biometric system identifies persons by his/ her biological features; they are very hard to fake [3].

There are three approaches of face recognition: the first one feature based approach which depends on facial characteristics such as eyes, nose, or mouth, the second is holistic based approach which it is depends on the whole face clip rather than face local features and the third one is hybrid based approach which it is a hybrid of the first and the second approaches ,this concept came from by which both the local characteristics and holistic face are perceives by human vision system (HVS) [10,4].

This paper presents a comparative study of algorithms to extract the feature of using fractal coding of the normalized face image which was localize and detect using skin colors of face as described in [9], after that is the removal of excess areas such as ear and neck using a threshold method for counting white pixels in each column and row. Several algorithms have been done to obtain the fractal code of the face .The results illustrated that the face recognition can be effectively using the suggested algorithms. The 2nd section of this paper explains some of the essential principles of fractal and fractal image coding(FIC) while the suggested algorithm that depend on FIC were explained in the 3rd section .The experimental results of the proposed algorithm were discussed in the 4th section and the conclusions are presented in the 5th section.

II. PRINCIPLES OF FRACTAL AND FRACTAL IMAGE CODING(FIC)

2.1 Fractal

Fractal was firstly introduced in geometry field, fractal geometry was usually found by the mathematician B. B. Mandelbrot later M. Barnsley, who found an invented way to apply this idea in data representing [13].

Arnaud Jacquin, one of the Barnsley Ph.D. students realized a first automatic fractal encoding in his dissertation, he suggested a modified scheme for representing images called Partitioned Iterated Function Systems (PIFS), the basic new idea in Jacquin's approach was very simple, which it is an image should not be thought of as a collage of copies of the entire image, but of copies of smaller parts of it , essentially Jacquin's approach depends on finding the local "self-similarities". It is an image that any one should not think of as copies collage of the entire image, yet as smaller parts copies of it[2]. Finding such self-similarity can be accomplished by dividing the original image at various scales, this led to a more useful system, which was called by Fisher the partitioned iterated function system (PIFS)[14]. Figure 1 shows Self-Similarity in Image [12].

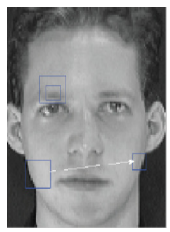

Figure1. Self-Similarity in Image [12]

The image is to be formed of copies of its properly transformed parts. These parts do not fit with each other, some error must be allowed in the representation of any image as a group of affine transformations, the encoded image as a group of transformations will never be the identical copy of their original image but it's rather, an approximation [13].

2.2 Encoder and Decoder

The encoder is required to find a set of contractive maps $w_1, w_2, \ldots, w_n$ using equation (1) and to find fixed point (attractor) of the map W[14].

$$w_i \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} a_i & b_i & 0 \\ c_i & d_i & 0 \\ 0 & 0 & s_i \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} + \begin{bmatrix} e_i \\ f_i \\ o_i \end{bmatrix} \qquad \ldots\ldots\ldots.. (1)$$

After partitioning a given image into R-blocks R_i and D-blocks pieces D_j the maps w_i should be found, so when w_i is applied to the part image over D_j, it must get some part that is as close as to any part image of the image over R_i Then, the encoding image finds the contractive maps w_i by which the distances between R_i and corresponding D_j are minimized [14]. Figure 2 show the transform between domain block (D_j) and range block (R_i) [8].

Figure2. The transform between domain block (D_j) and range block (R_i)[8].

That is why fractal coding is slow, because each range block has to be compared with all domain blocks, for each of these comparisons all eight symmetry orientations must be checked to find the best match. The decoder is much simpler and faster than encoder, starting from a basic image f_0, the final image can be obtained by repeating through the set of maps W. On the first repetition, $f1$=w

(f_0), and on the second repetition =w (f_1) = w (w (f_0)), etc. This process can be repeated until the attractor resembles the original image [6].

III. PROPOSED FACE RECOGNITION SYSTEM

The proposed face recognition system consists of two main phases: training and testing phases, the entrance of the two phases will be the face image.

3.1 training phase

It consists of the following stages: Read Face Image ,Encoder ,Creation Binary File .In this phase after read the data of the face image the data will passed through the encoder to find it's IFS code set (code file)using FIC method, then the information of this face image and it's IFS code set will be store in a binary file which it is considered as a feature.

3.1.1Read Face Image stage

In this stage the face image is loaded and the image header information is being read at first then , the image data is separated into three arrays of R,G,B are called face detected information.

3.1.2 Encoder stage

The steps of the encoder stage as shown in Figure 3 is: color transformation, down sampling bands (I and Q), resizing the bands (Y, I', Q') and FIC encoding. At this stage IFS code for each person will be found and the following section will explain in detail all the sub-steps of encoder.

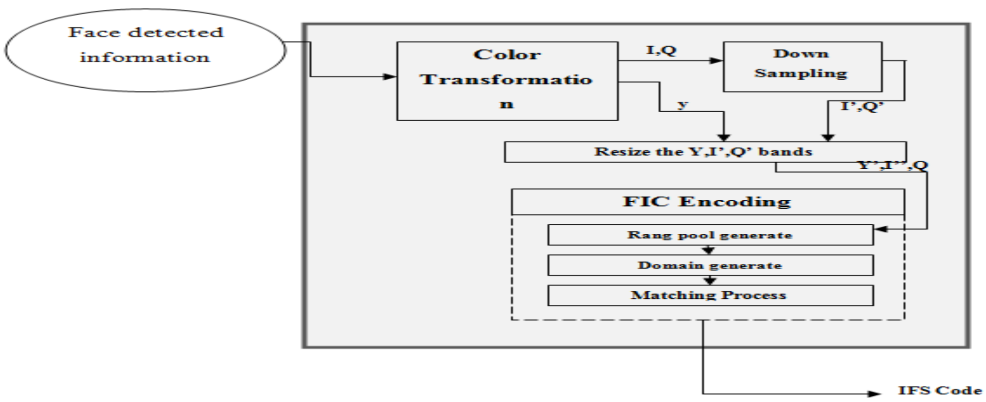

Figure3. Encoder stage

The three obtained basic bands (Red, Green, and Blue) from the previous read face image stage are transformed into the YIQ colors pace. This step is important to make the image data representation more suitable for coding because most of the data energy is concentrated in Y component, while I, Q components are convey little part of the image information energy .Transformation is done by using equation(2)[12]and the result is shown in Figure 4 where (a) Represent the Input face image,(b) Represent the Y-component of YIQ color space, (c) Represent the I -component of YIQ color space and (d) Q -component of YIQ color space.

$$\left.\begin{aligned} Y &= [0.299 \ \ +0.587 \ \ +0.114] \ . \ [R] \\ I &= [0.596 - 0.274 \ \ -0.322] \ \ . \ [G] \\ Q &= [0.211 - 0.523 + 0.312] \ \ . \ [B] \end{aligned}\right\} \ldots\ldots\ (2)$$

Figure4. YIQ color space transform

Due I and Q has no high discrimination power against the contents of Y-component therefore, the chrominance components are down-sampled by2 using the averaging method and since the averaging method requires the numbers of columns and rows should be even, and because the input face has a different dimensions, additional process are taken to handle the problem of the odd numbers of columns or rows by creation the column or row that will be added by using the bilinear interpolation method.

Y-,I'-and Q'-color bands will be the input to next FIC encoding step .In FIC encoding process step will be generated the range pool by partitioning the face image using a fixed size partitioning method depended on the block size ,it can be either 2x2, 4x4, 8x8, or16x16, but here's a problem will appear because of the input face image has different dimensions and these dimensions are maybe not as multiples of the block length so the image will lose some of its pixels ,it is solved by using an additional process which it is re-sizing the Y-, I'-, and Q'-bands to set their dimensions as multiples of the block length, bilinear interpolation method will be used to create the additional columns and rows, this number of additional columns or rows is determined using the following equation: $N = B(T/B) - T$ (3)

Where: T is the width or height of the image, B is the block size, and N is the number of additional columns or rows.

FIC encoding process is the most important step to find the IFS code for each person ,this sub-step is based on a set of parameters ,in this paper several tests have been made to determine the values of those parameters ,the parameters that have been adopted in this paper as follows: block size is equal to 2x2, jump step(it is the distance between any two adjacent domain blocks) is equal to 1, the allowed error between the matched range and domain blocks is equal to 0.3, MaxOffset and MinOffset were fixed at (255) and (-255), respectively, Maximum scale and Minimum scale were fixed at (3) and (-1.5), respectively, all symmetry orientations have been used, and the number of iteration is equal to 8.

All parameters that are mentioned previously will be the input to the FIC encoding process as well three resized Y'-, I''- ,and Q''-color bands and it's width and height .The three color bands are passed sequentially in FIC encoding process in order to encode individually (i.e. this operation will be applied three times, once for every band).

The first process in FIC Encoding sub-step is generated range pool .In generation process the resized Y'-component, and the resized down sampled I''-, and Q''-color bands are partitioned using a fixed size partitioning method because it requires less computational time than the other.

The second process is down sampling by 2 Y'-,I''- and Q''- image in order to be the domain then, the domain pool is generated by partitioning the down sampled bands into overlapped blocks using moving window method. The overlapping space depends on the jump step of the moving window .

Matching process will be searched in the domain pool for the correct block which is similar to the range block in order to find IFS code, but before starting this process some involved parameters must be found, such as:

a. Number of range blocks in horizontal and vertical directions (NxR and NyR) in the range pool is computed by:

$$\left.\begin{aligned} \text{NxR} &= \text{nWid div BlockLength} - 1 \\ \text{NyR} &= \text{nHgt div BlockLength} - 1 \end{aligned}\right\} \dots\dots\dots (4)$$

b. Number of domain blocks in the horizontal and vertical directions

(NxD, NyD) in the domain pool is computed by:

$$\left.\begin{aligned} \text{NxD} &= (\text{Wid}'' - \text{BlockLengh}) \text{ div JumpStep} \\ \text{NyD} &= (\text{Hgt}'' - \text{BlockLengh}) \text{ div JumpStep} \end{aligned}\right\} (5)$$

c. Number of blocks in domain pool (NoD) is computed by:

$$\text{NoD} = \text{NxD} * \text{NyD} + \text{NxD} + \text{NyD} \dots\dots\dots . (6)$$

Since the search process in the domain pool to find the corresponding block is a time-consuming because of the eight operations of symmetry ,so add an additional process , which first for each rang block makes sure if all block pixels have the same value, so there is no need for the search process in domain pool, but only store the value of one pixel of this block pixels and make scale (s) equal to

1 and the value of the offset(o) is equal to 0 and symmetry is 0, the coefficients of each IFS code set is contained the following parameters:
$(\text{position}(X, Y), \text{Scale}, \text{ofset}, \text{symmetryIndex}, \text{valueofthepixel})$.Algorithm (1) shows the process of finding IFS code sets.

Algorithm (1) Matching process

Input: JmpStp// number of pixels to jump between two domain blocks, NxR// the number of blocks in the width of the range pool
NyR// the number of blocks in the height of the range pool , Y"or I" or Q" and its domain// rang pool and domain pool
NoD// the number of domain blocks

Output: IFS ( )// array of record of 6 cells (Xd,Yd, O, S, Sym, pix).

Begin

Step1:// Find IFS Code

For Ix 🡨 0 to NxR loop For Iy 🡨 0 to NyR loop
if All block pixle's not same value then go to step 2
Else

// Register the IFS coefficients and save them in IFS( )

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IFS (Ix,Iy). pix 🡨value of one of block pixle's : IFS (Ix,Iy).O🡨zero // The Scale value
IFS (Ix,Iy). S🡨1 // The offset value **:** IFS (Ix,Iy).sym🡨 zero // The symmetry index
IFS (Ix,Iy).X🡨1 // The optimal Dimension X of the domain block : IFS (Ix,Iy).Y🡨1 // The optimal Dimension Y of the domain block
Else

Step2 : //Search in the domain blocks

For j 🡨 0 to NoD loop

Determine the Scale coefficient (S) [5] // The optimal **Scale**

$$s = \frac{[n(\sum_{i=1}^{n} d_i r_i) - (\sum_{i=1}^{n} d_i)(\sum_{i=1}^{n} r_i)]}{\left[n\sum_{i=1}^{n} d_i^2 - (\sum_{i=1}^{n} d_i)^2\right]} \quad \text{.......... (7) :}$$

Determine the offset coefficient (O) [5] // The optimal **offset**

$$o = \frac{[\sum_{i=1}^{n} r_i \sum_{i=1}^{n} d_i^2 - \sum_{i=1}^{n} d_i(\sum_{i=1}^{n} d_i r_i)]}{\left[n\sum_{i=1}^{n} d_i^2 - (\sum_{i=1}^{n} d_i)^2\right]} \quad \text{.......... (8)}$$

:Compute the error between range and domain blocks using eq.(9) [5] .

$$E(R, D) = \frac{1}{n}[\sum_{i=1}^{n} r_i^2 + S(S\sum_{i=1}^{n} d_i^2 - 2\sum_{i=1}^{n} d_i r_i + 2O\sum_{i=1}^{N} d_i) + O(On - 2\sum_{i=1}^{n} r_i)]$$

If $E(R_i, D_i) < \textit{minimum registered error}\ (E_{\min})$ then **//Register the optimal IFS coefficients and save them in IFS( )**

IFS (Ix,Iy). S🡨S //The optimal scale coefficient : IFS (Ix,Iy).O🡨O //The optimal offset coefficient
IFS (Ix,Iy).sym🡨OptSym //The optimal symmetry index : IFS (Ix,Iy). pix🡨**-1** // All block pixle's haven't the same value
IFS (Ix,Iy).X🡨 Xd // The optimal Dimension X : IFS (Ix,Iy).Y🡨 Yd // The optimal Dimension Y
End Loop
End if

End Loop End Loop
Step3 : Return **IFS** (Xd, Yd, O, S, Sym, pix). // IFS code
End

The purpose of the creation binary file step is to get the protection and confidentiality, at first the file must be prepared to save face image's information at the beginning of the file binary (width, height of the face image for each band, the block size, number of blocks in the width and height of the range pool) and then the IFS code sets which were found in the encoder step will be stored in binary file then the binary file will be stored in the database as a feature.

3.2 Testing Phase

This phase as illustrated in Figure 5 will be shown five stages consist of: Read Face Image, Load IFS Code, Modification of the Face Image, Decoder and Identify, these stages will be explained in the following subsection. In Load IFS Code stage the IFS code is loaded from the binary file ,but at first the contents of header file(width, height of the face image for each band, the block size, number of blocks in the width and height of the range pool) must be extracted ,then the face image will be modify in modification stage, it is an important stage, because in this research adopted a process for the retrieval of the face image ,which it is using the input face image as initialize domain pool in next decoder step, but the problem will occur here, the IFS code has been extracted in load IFS code stage was for the face image with certain specifications which are: the specific dimensions ,color space is YIQ color space and the two bands (I and Q) was down sampling ,this requires modification of the extracted face image in order to make it conform to the specifications listed above .It is being done with all the binary files that is loaded and in the following the steps: first the face image is transform to YIQ color space and this transformation is done by using eq 2[7] ,then will be adjusted each time depending on the block size, number of blocks in the width of the range pool and the number of blocks in the height of the range pool ,which has been extracted from the load the IFS Code step, Bilinear Interpolation method was used to adjust the size of range pools to get (Y', I'' and Q'') and it will be the input to the decoder step In addition to number of blocks in the width and height of the range pool and ifs code .algorithm 2 explained All the operations that are made in order to find the PSNR for each file.

the size of the three reconstructed range pools(Y',I''and Q'') are adjusted to be equal to their original size depending on the original size that has been stored in binary file .Bilinear interpolation method was used to adjust the size of range pools to its original size and then to re-sized of the restructured range pools of the chromatic bands (I' and Q') are up sampled to make it equal to the size of Y-component.

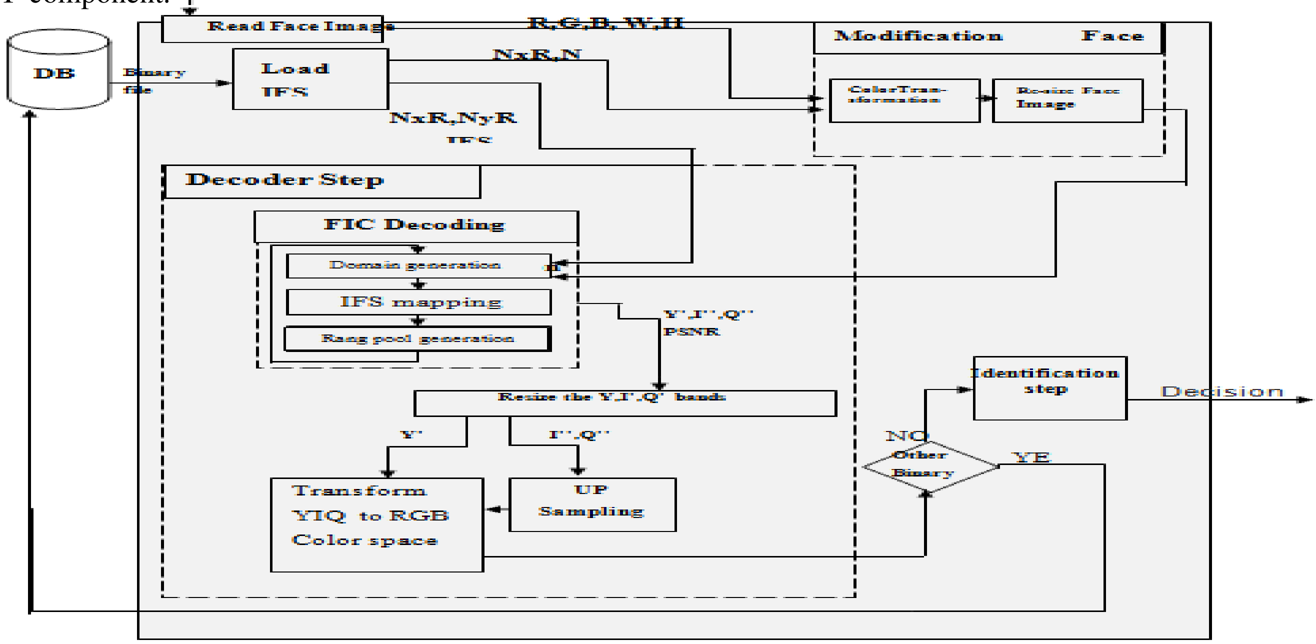

Figure5. Testing Phase

After that the reconstructed bands (Y, I, Q) are converted to (R, G, B) bands color space, this transformation is done by using eq. (10) [12].

$$\left.\begin{array}{l} R = [1 + 0.956 \quad + 0.621] \;.\; [Y] \\ G = [1 \text{ -}0.272 \quad \text{-}0.647] \;.\; [I] \\ B = [1 \text{ -}1.105 \quad +1.702] \;.\; [Q] \end{array}\right\} \qquad (10)$$

In Identification stage the input will be all PSNR values with its ID(person ID)that have been be found in the previous decoder stage for each person ,each PSNR value for a particular person can be recognized through the ID(person ID), greatest PSNR value will be found and if it higher than threshold value then it is the recognized image .if all PSNR values less than threshold value there is no image the same person in the database .Figure 3 show One of the binary files that have been retrieved after five iteration with different facial image , the highst PSNR (28.83) is when retrieved the binary file based on image (a) Because it is for the same person While the PSNR (24.98) is less when retrieved the binary file based on image (b) Because they are the same person but in different Expressions and with glasses, as for the lowest PSNR (20.24) was for image (c) Because it is a different person.

Algorithm (2) FIC Decoding Process
Input: IFS code **IFS** (Xd, Yd, O, S, Sym, and pix). **Output:** the three bands (Y', I" and Q "). **Requirement of the decoding process**: Initial image, data of the IFS code , determining the number of iteration

Begin
Step 1: //For the three bands (Y', I" and Q ")
Read initial image to generate range pool and then down sample range pool using averaging method to create the domain pool.
Step 2: Using the same partitioning technique that used in encoding stage which was FPT technique to create range and domain blocks of equal sizes.
Step 3: for each IFS code
IFS code (Xd, Yd, O, S, Sym, and pix) must be read // each IFS code represent one range block)
If pix <> -1 // It means all Block pixels's Values dissimilar
searching for the domain block in domain that matches range block according to the saved orientation information IFS code (IFS (Ix,Iy).X, IFS (Ix,Iy).Y)
Step 4: applied the IFS code on this domain block by
Apply the required symmetry that saved in IFS code which rotate or reflect or both the domain block.
Multiply the content of transformed domain block by scale s_i then add this result to offset coefficient o_i by using eq.(11)[14] which reconstructed the approximate range blocks.
$R' \approx sDi + o$……….(11)
Else
consider the values of each pixel of the domain block(Di) = value pix
Multiply the content of this domain block by (s_i=1)then add this result to offset coefficient($o_i = 0$)by using eq(11) $R' \approx sDi + o$
which reconstructed the approximate range blocks

Step 5: Repeat steps 3 and 4 until complete the reconstruction of all range blocks (the reconstructed image) which has size equal to size of the three bands (Y', I" and Q "). That has been stored it's measured in binary file.
Step 6: Repeat steps from 2 to5 for number of iteration
Step 7: Calculating the mean square error (MSE) and (PSNR) between the reconstructed range and the previous reconstructed range image[11].

$$\text{MSE} = \frac{1}{\text{N} \times \text{M}} \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} [\hat{f}(x,y) - f(x,y)]^2 \ldots \ldots \ldots \ldots \ldots (12)$$

$$\text{PSNR(dB)} = 10 \log_{10}[\frac{(L-1)^2}{\text{MSE}}] \qquad \ldots \ldots \ldots \ldots \ldots (13)$$

Step 8: Find average of (PSNRs) Which was calculated for the three bands (Y', I" and Q").
End

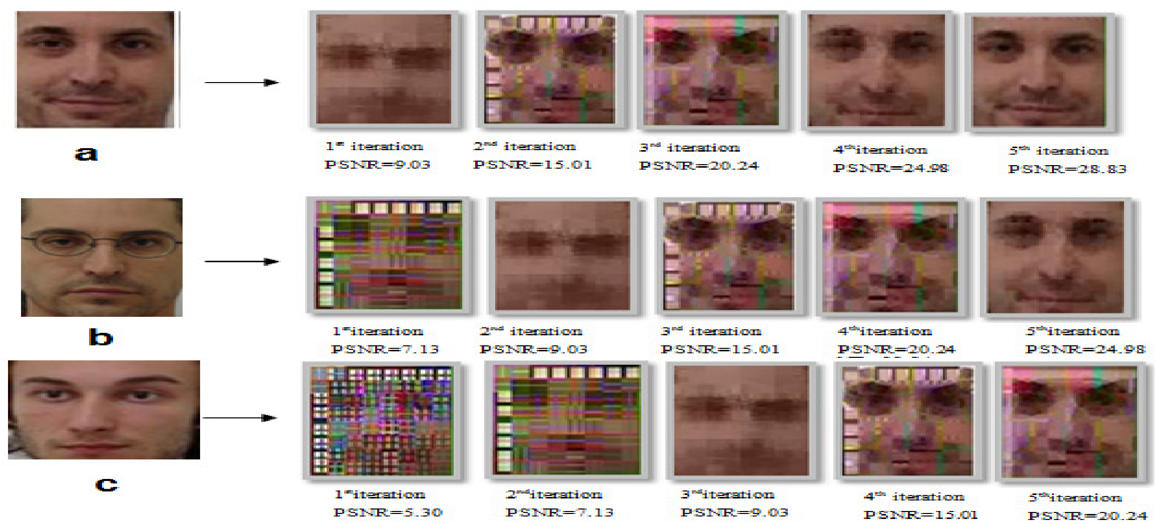

Figure6. One of binary files that have been retrieved with different facial image

IV. EXPERIMENTAL RESULTS

The system Dataset is based on is the FEI face database part one; it is a face database in Brazil that includes a group of face images which were taken from June, 2005 to March, 2006 at the Artificial Intelligence Laboratory of FEI located in São Bernardo do Campo, São Paulo, Brazil. In this part or the dataset, there are (14 images) belong to each one of (50 persons) All faces are mainly belongs to FEI students and personnel, aging 19-40 years with distinct appearance, hairstyle, adorns and different expressions (look up/done open/closed eye and smiling/non-smiling, with/without glasses). Testing face image group, refers to the group of entire samples that are extracted from the dataset to be tested, 3samples for each individual were used (front view smiling with/without glasses, left/right rotate 45).

The evaluation of face recognition system performance can be calculated by using two measures, which are called Recognition Rate (RR) and False Alarm Rate (FAR). These measures can be calculated using Equations (14) and (15), respectively.

1. Recognition Rate: is defined as the ratio between the numbers of correct recognition decision to the total number of attempts: $\text{RR} = \frac{\text{Correct Attempts Number}}{\text{Attempts Total Numbers}} * \times 100\% \ldots (14)$

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2.FAR: is defined as the ratio between the numbers of false recognition decision to the total number of attempts:

$$FAR = \frac{\text{False Recognition Attempts Numbers}}{\text{Attempts Total Numbers}} \times 100\% \ldots\ldots\ldots\ldots\ldots (15)$$

FIC control parameter of the face affects the recognition behavior of the proposed face recognition system, so several tests have been performed to explore the effect of coding parameters to enhance the coding performance parameters of the system to get highest PSNR .We fixed some of parameters to examine the effect of the others, such that the Maximum and Minimum Offset parameters are fixed in all test at (255,-255) respectively and the effects of the other parameters which is : block size , step size , ScaleBits , Max. and Min. scale, symmetry and permissible error value (ε) is shown in Figure7, Figure8, Table 1, Table 2, Table 3 and Table 4 respectively while the Coding parameters with best results and the final result of testing face recognition system based on it is shown in Table 5, Table 6 respectively.

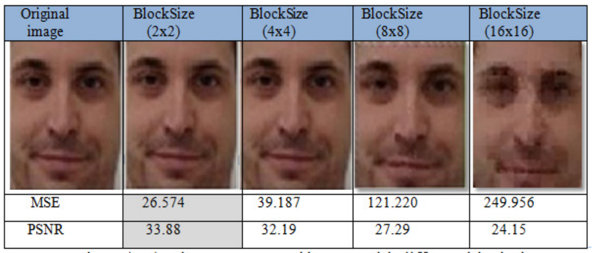

Figure7. The reconstructed images with different block size.

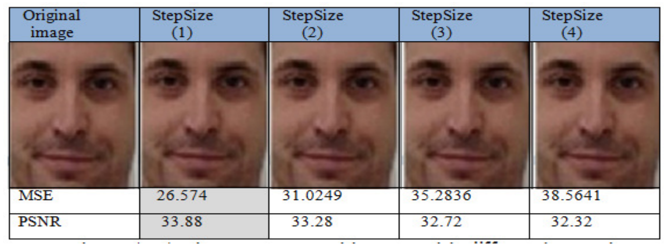

Figure8 .The reconstructed images with different step size

Table1. The effects of ScaleBits symmetry Parameter

	Scale Bits			Offset Bits			MSE	PSNR
	Y	I	Q	Y	I	Q		
Quantization	3	3	3	5	5	5	55.056	30.786
	3	3	3	6	6	6	43.033	31.795
	3	3	3	7	7	7	40.088	32.030
	4	4	4	5	5	5	40.322	32.133
	4	4	4	6	6	6	36.360	32.580
	4	4	4	7	7	7	63.11	32.617
	5	5	5	5	5	5	36.240	32.017
	5	5	5	6	6	6	32.947	33.092
	5	5	5	7	7	7	35.376	33.718
	6	6	6	5	5	5	31.402	32.285
	6	6	6	6	6	6	30.024	33.285
	6	6	6	7	7	7	34.360	33.785
	7	7	7	5	5	5	36.81	33.336
	7	7	7	6	6	6	26.691	33.
	7	7	7	7	7	7	29.484	33.511
No Quantization							26.574	33.88

Table2. The effects of Max. and Min. scale Parameter

MaxScale	MinScale	MSE	PSNR
1	-1	33.408	32.89
	-1.5	30.913	33.08
	-2	29.593	33.41
	-2.5	32.832	32.96
	-3	26.832	32.84
2	-1	26.9361	32.82
	-1.5	26.728	33.86
	-2	27.041	33.81
	-2.5	27.248	33.84
	-3	26.904	33.83
3	-1	26.904	33.83
	-1.5	26.574	33.88
	-2	26.832	33.84
	-2.5	26.832	33.84
	-3	27.352	33.76

Table3. The effects of Parameter

Sym.	MSE	PSNR
0	42.902	31.85
1	52.272	30.97
2	41.990	31.93
3	50.552	31.12
4	43.692	31.77
5	49.843	31.19
6	43.428	31.79
7	49.843	31.19
(0-3)	34.928	32.76
(4-7)	33.988	32.87
Full	26.574	33.88

Table4. The effects of permissible error value (ε)

ε_0	MSE	PSNR
0.1	26.594	33.882
0.2	26.584	33.884
0.3	26.574	33.885
0.4	26.604	33.881
0.5	26.62	33.877
0.6	26.832	33.844
0.7	26.925	33.829
0.8	27.019	33.814
0.9	27.144	33.794

Table 5 .Coding parameters with best results

Quantization	Maximum Scale	Minimum Scale	Block Size	Step Size	down sampling	Permissible Error Value (ε)	Symmetry
NO	3	-1.5	2X2	1	By 2	0.3	all

Table 6. The final result of testing face recognition system

Recognition Rate			
Evaluation Criteria			
Total Attempts	False Attempts	FAR	RR
150	18	11.9%	88.1%

V. CONCLUSIONS

This work has demonstrated that the effect of control parameters is indeed a practical solution to generate proper feature vectors from feature extraction stage, experiments found that the values of FIC parameters that give the best results in the face recognition system were as follows:

a- The values of the Block Size parameter is (2x2).
b- The values of Maximum and Minimum Scale parameter is 3,-1.5 respectively.
c- The values of Step Size parameter is 1.
d- The values of Down Sampling parameter is by 2.
e- The values of Permissible Error (ε) parameter is 0.3.
f- The Symmetry parameter is Adoption of eight symmetry
h- The Iterations Number parameter is eight.
i- The Quantization parameter Gave a high compression ratio but with less PSNR Compared with the no Quantization parameter, and because this Thesis based on the Quality, for this reason the no Quantization parameter is adopted.

Based on previous parameters the rate of Face Recognition is 88.1% has been reached.

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