A Novel Determine the Identity of the Student in the Distance Examinations Depending on Face Recognition Techniques

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***Abstract*—the objective of this paper is to create an automatic system to determine the identity of the student in the distance examinations depending on face recognition techniques. This system used face print and hand print to determine the identity of the student. A survey of feature extraction methods for content based image retrieval (Gray Level Co-occurrence Matrix, Color Moments and Color Coherent Vector) are presented also.**

Keywords-Face Recognition; Image Retrieval; Gray Level Co-occurrence Matrix; Color Coherent Vector; Pattern Recognition.

1. INTROUDUCTION

Face recognition (FR) is one of the biometrics systems that include finger print, palm print, iris print and sound print. Biometric face recognition technology has met with great interest in the research domain through past years because of its potential for a wide variety of applications in several domains. Face recognition is one of the most important biometric technologies which are characterized as a non-intrusive and easy to use method. It aimed to give solution to know many needs for identification and the verification of identity persons [1, 2]. The different identification systems include two types of data: data can be falsifying such as name, address and social security number and data cannot be falsifying such as face print because it is impossible to falsify biometric characteristics. In face recognition systems the facial features convert into usable representations [3]. An automated face recognition biometric system is a pattern recognition system that works by getting biometric data (face image) from the person, extracting image, saving image features in database. Then comparing the new face image feature set with the biometric template or representation of features already acquired in a database [4]. The face recognition process has some steps which could be explained as follows [5, 6]:

- Capture the image by using digital camera or video camera.
- Detecting faces, in this stage person's face are cutted, isolated and saved in database.
- Features extraction, this done by creating a biometric template or mathematical representation for the facial feature to be compared to those in the gallery (reference database).
- Pattern recognition, identification and the person's face is identified.

Face recognition systems can be used for tasks as following [3]:

- Verification; this is the least complex task in face recognition systems. It is aimed to verification of the person who has pre-existing relationship with the institution. This means that the person has already images and feature template in the gallery or the reference database. In this task there are two possible outputs: the person is not recognized, the person is recognized and access.
- Identification. This task is differs from the previous task in that the person has not pre-existing relationship with the institution, due of this the identification is more complex than verification. Identification aimed to know that the person can to be identified is in the reference database and given his data. In this task there are two possible outputs. The person identification, this means that the person has an image in the reference database. The

person not identification, this means that the person has not an image in the reference database.

The face recognition approaches are divided into two points as following [7]:

- First point based on the geometrical relationships between facial landmarks as a means to facial features.
- Second point based on the facial processed as a general pattern, which are based on photometric characteristics of the image.

2. The PROPOSED SYSTEM

The proposed system aims to determine the identity of the student in the distance examinations depending on face recognition techniques. The system works in three levels, each level aims to achieve some goal.

- First level aims to capture the student's image and detect the student face.
- Second level aims to cut the faces and save them in database1. The features of the face image is extracted and saved in database2.
- The third level aims to identify the student face during the exam process. This occurs by extracting student face image features and compare it with the features saved in database2. This process allows four trials to student before the exam process finishes. Figure 1 shows the flowchart of the proposed system.

2.1 Student's Images Acquisition

The digital images for students are acquired or captured by using digital camera these images are divided into:

- Single student image.
- Students among group image.
- Vail image.
- Hand image.

2.2 Student's Image Preprocessing

The image preprocessing is divided into three parts:

- Detect the face image from the overall picture.
- Cut the face image and save it in database1.
- Save hand image in database2.

2.3 Image Feature Extraction

The feature extraction techniques used in this system are:

- Gray level co-occurrence matrix (GLCM).
- Color moments.
- Color coherence vector (CCV).

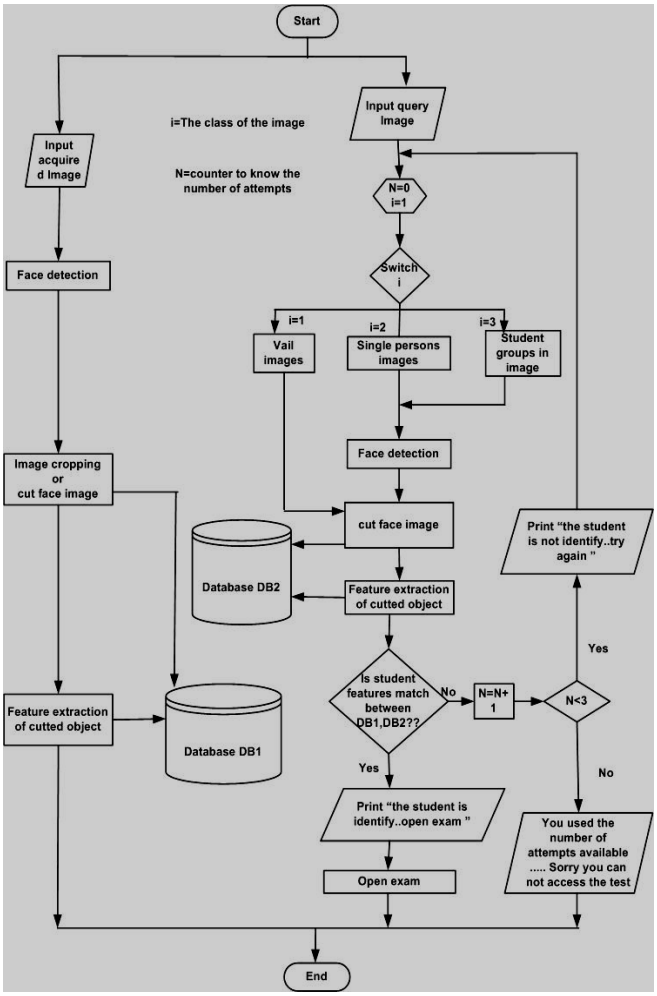

Figure 1: The Flowchart of the Proposed System

The extracted features are saved in database related to the feature method. The next section concerns with the explanation of each technique.

A. Gray level co-occurrence matrix

The GLCM technique is applied on gray-scale images consequently the color image will be converted into gray-scale image [8, 9]. The features extraction by GLCM has the following step:

- Resize the face image.

- Convert the color face image into gray level image.
- The main GLCM features are energy, contrast, correlation and homogeneity. Each of them is explained as follows :

$$Energy = \sum_{i,j} p(i,j)^2 \quad (1)$$

Where:

i , j : are a single pixel.

p(i, j): Is the probability that two pixels with a specified separation have grey levels i and j.

$$Contrast = \sum_{i,j} |i-j|^2 p(i,j) \quad (2)$$

$$Correlation = \sum_{i,j} \frac{(i-\mu_i)(j-\mu_j)p(i,j)}{\sigma_i \sigma_j} \quad (3)$$

Where:

μi, μj : Represents the horizontal and the vertical means in the matrix.

σi and σj : Represent standard deviation.

$$Homogeneity = \sum_{i,j} \frac{p(i,j)}{1+|i-j|} \quad (4)$$

B. Color Moments

Color moments used here are mean, standard deviation, skewness and kourtasis [10,11]. These features are explained as follows:

- Mean, or the average value in the image. It calculate by this equation

$$u_i = \frac{1}{N} \sum_{j=1}^{N} f_{ij} \quad (5)$$

Where:

N : is the number of pixels in the image.
Fij : is the value of the i-th color component of the image pixel j.

- Standard Deviation, the square root of the variance of the distribution. It calculates by the following equation.

$$\sigma_i = \sqrt{\frac{1}{N}\sum_{j=1}^{N}(f_{ij}-u_i)^2} \quad (6)$$

- Skewness, is measure of the degree of asymmetry in the distribution. It calculate by this equation.

$$S_i = \sqrt[3]{\frac{1}{N}\sum_{j=1}^{N}(f_{ij}-u_i)^3} \quad (7)$$

- Kourtasis (Ki) is the fourth color moment. It calculate by this equation.

$$K_i = \sqrt[4]{(\frac{1}{N}\sum_{j=1}^{N}(p_{ij}-E_i)^4)} \quad (8)$$

C. Color Coherence Vector

Color Coherence Vector (CCV) classifies the pixels of image as either coherent or incoherent depending on the size of its connected component. A pixel is coherent if the size of its connected component exceeds a fixed value τ; otherwise, the pixel is incoherent. CCV describe image's color depend on Set default color by divided the image pixels into [11,12]:

- Pixels with that color will be coherent, it called α_j.
- Pixels with that color will be incoherent, called β_j.

$\alpha_j + \beta_j$: total number of image pixels. for each color the pair (α_j, β_j) : are computed, it is called coherence pair for the jth color.

The color coherence pair's vector for the image consists of :

$$\langle \alpha_1+\beta_1,....\alpha_n+\beta_n \rangle \quad (9)$$

3. The PROPOSED SYSTEM IMPLEMENTATION

3.1 The framework

The proposed system works in two ways:

- First way; this done before the Distance Examinations, in it database1 and database2 which use in matching process are created. In it the faces images are saved. To getting the face image the system deal with four types of images Single student image, Students among group image, Vail image and hand image. In the first three types the image's face detected and cutted and saved in the main database. Then used the feature extracted method for getting the face's features. Finally the face image, face

feature and student name are saved in database1. As to hand image its features extracted by using feature extracted method, then the student name, student image, student hand image and its features are saved in database2.

- Second way; this done during the exam. It aims to getting the decision is this the student or no by using query image. To determine the student the query image feature will be extracted by using feature extracted methods then matching with the images features in database1 or database2. The percentage of similarity calculated by using Weighted Euclidean Distance then this percentage sorted in descending order to the nearest 15 image.

The student has been identified depending on the most percentage of similarity. Performance measures are calculated by applied the recall and precision [13].

$$\text{Recall} = \frac{\text{Number of relevant images retrieved}}{\text{Total number of images in database}} \quad (10)$$

$$\text{Precision} = \frac{\text{Number of relevant images retrieved}}{\text{Total number of images retrieved}} \quad (11)$$

3.2 The Implementation

The proposed system has three graphical user interface (GUI). These can be explain as following:
First GUI aims to capture the student's image (student images in a group, single student images and Vail images for female) and detect the face. This GUI deals with three types of images that shown in figures 2,3 and 4.

Figure 2: Student images in the group

Figure 3: Single student images

Figure 4: Vail images for female

The first GUI is consisted of:

- The button "Select image" is used to select student image and display it in axes beside it.
- The button "Detect face" is used to detect faces in the image and display it in axes.
- The button "Press to view result detect" is used to view detected faces.
- The button "Clear" is used to clear GUI.
- The button "Exit" is used to exit GUI.

The second GUI aims to cut the face image, show the faces in its axes and find the features of the faces image. This GUI shown in figures 5,6, and 7.

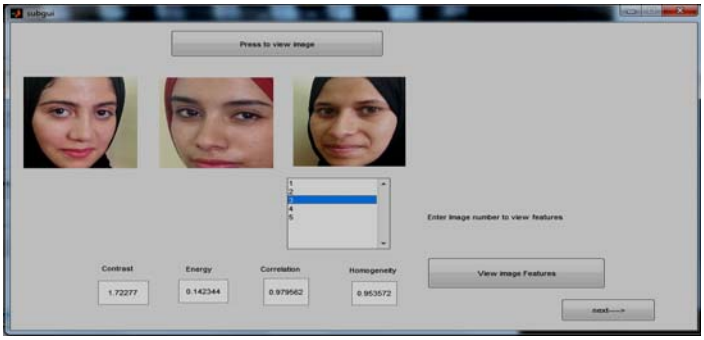

Figure 5: Cutted face from student images in a group

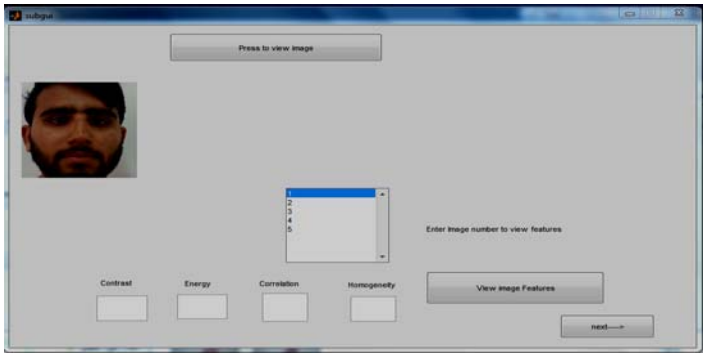

Figure 6: Cutted face from single student images

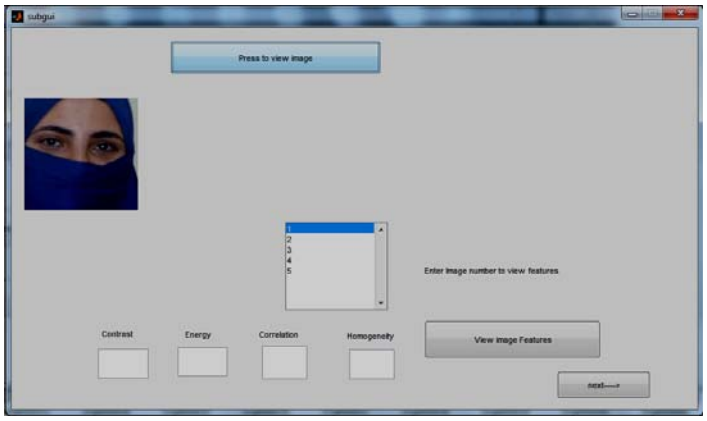

Figure 7: Cutted face from Vail image

The second GUI is consisted of:

- The button "Press to view image" is used to view detected faces, every face in one axes (maximum five faces).
- The Popup menu "Enter image number to view features" is used to select the face's number that required getting its features.
- The button "view image feature" Is used to view face features. The button "next" is used to move to the next GUI.

The third GUI aims to determine the identity of the student by using palm print and face print, so that third GUI can be divided into two parts palm print and face print.

This section explains the part of third GUI that determines the identity of the student by using palm print. This shown in figure 8.

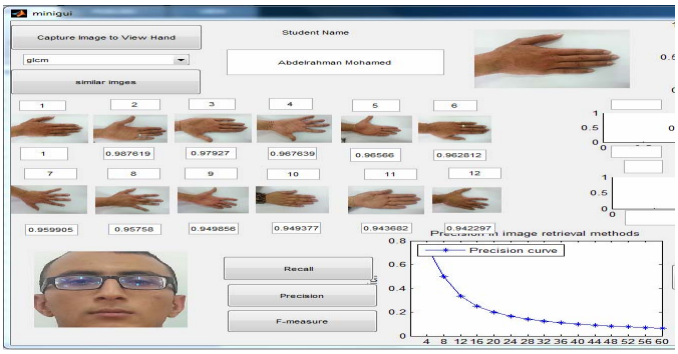

Figure 8: Palm print

The third GUI (handprint) is consisted of:

- The button "capture the image to view hand" is used to select student's hand image and view its details.
- The Popup menu "GLCM" is used to choose image retrieval method among (GLCM, CCV, Color moments, GLCM & CCV).
- The button "similar images" is used to display the first 12 of hand images similar to query image. Also the image ID & image similarity are displayed under each image.
- The text "student name" is used to display student name.
- The button "recall" is used to display recall curve.
- The button "precision" is used to display precision curve.
- The button "f-measure" is used to display f-measure curve.

This section explains the part of third GUI that determines the identity of the student by using face print. This shown in figure 9.

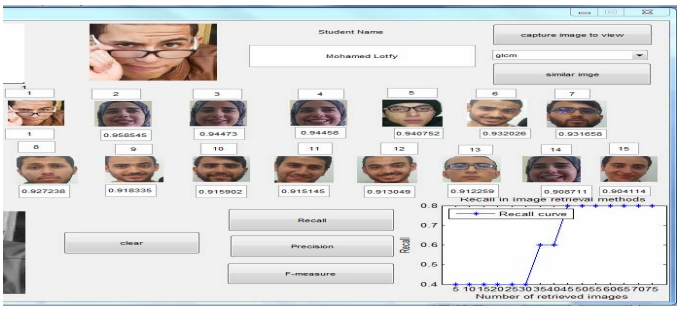

Figure 9: Face print

The third GUI (face print) is consisted of:

- The button "capture image to view" is used to select image to show and view its details.

- The Popup menu "GLCM" is used to choose image retrieval method among (GLCM, CCV, Color moments, GLCM & CCV).
- The button "similar images" is used to display the first 15 images similar to query image. Also the image ID & image similarity are displayed under each image.
- The text "student name" is used to display student name.
- The button "recall" is used to display recall curve.
- The button "precision" is used to display precision curve.
- The button "f-measure" is used to display f-measure curve.
- The button "clear" is used to clear GUI.

4. EXPERIMENTAL RESULTS

4.1 Student Identification via Hand Image

The hand image database is used for determine the identity of the student based on his or her handprint depending on getting features from these hand images by using feature extraction techniques. It includes 60 images. Each student has 4 images. Two images for right hand and two images for left hand. One for inside and other image for outside.

The user input a query hand image then the proposed system getting its features by feature extraction techniques that used and match the query image with the images that was saved in the hand database.

After that getting the nearest 12 similar images and determine the student and display the student information (student name and image). Table 1 shows the run time and CPU for hand images.

TABLE 1: The run time and CPU for hand images

Run time and CPU for hand image

Feature Extraction Methods	Time			
	Learn Time (sec)		Test Time (sec)	
	CPU	Run	CPU	Run
GLCM	34. 6732	36.1421	4. 2342	3. 1236
CCV	409.4361	410.623	8.1432	7.9865
GLCM+CCV	430.3435	431.3459	8.6552	8.9794
Color moments	29.4521	30.1125	3.1678	2.96812

4.2 Student Identification via Face Image

The face image database is used for determine the identity of the student based on his or her face print depending on getting features from these face images by using feature extraction techniques. It includes 75 images for 15 students. Each student has 5 images in different view.

The user input a query face image then the proposed system getting its features by feature extraction techniques that used and match the query image with the images that was saved in the face database.

After that getting the nearest 15 similar images and determine the student and display the student name.

Table 2 shows the run time and CPU for face images.

TABLE 2: The run time and CPU for face images

Run time and CPU for face image

Feature Extraction Methods	Time			
	Learn Time (sec)		Test Time (sec)	
	CPU	Run	CPU	Run
GLCM	39. 9821	42.6541	5. 1341	4. 0328
CCV	445.6361	440.423	9.0432	8.2341
GLCM+CCV	460.7415	451. 5658	10.3126	10.2768
Color moments	34.6421	36.1256	4.6678	3.99812

5. CONCLUSION

Image processing is an easy way to identify the student's identity in distance education. The proposed system is applied on different types of images single student image, students among group image, Vail image and Palm print.

This study proposed a model for the Content Based Image Retrieval System which depend on image's features. The feature extracted by four different methods (Gray Level Co-occurrence Matrix, Color Moments and Color Coherent Vector). The system has been developed successfully in an effective manner by achieving the targeted output. The system designed with a flexible and consistent flow for easy understanding.

6. FUTURE WORK

The proposed system aimed to create a system for determine the identity of the student in the distance examinations using Gray Level Co-occurrence Matrix, Color Moments and Color Coherent Vector as example of methods used for image feature extraction. However there are still many issues to be further investigated by using another feature extraction methods. Discrete Wavelet Transform , Gabor Wavelets and segmentation of skin color

method are the most famous and important methods for recognition and feature extracted. These methods can be used in future in various domains. The researchers think about propose new system applied these algorithms using 3D images in the medicine domain specially in beauty surgery and treatment of the effects of burns.

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