Face Recognition and Retrieval Using Association Rules in Android Operating System

Dr.Abdul-Wahab Sami Ibrahim, Raniah Ali Mustafa

Abstract— The task of face recognition has been actively researched in recent years. The goal of this paper is to implement face detection and face recognition system on the Android Operating System for use on mobile devices. After difficulties were experienced while attempting to integrate the two Components, a Visual Basic implementation was accomplished instead. In this paper, we present face detection algorithm was successfully implemented on Android Operating System version (4.3) which involved programming in Java language version 6 and face recognition system successfully implemented in programming language visual basic 6.0. The main idea of the proposed system depends on the fact that any face image person has multi unique features. These features are different from one face image to another. Our proposed algorithm depends on moment invariants to extract features from the face image person to extract association rules between these features to recognition face images person and retrieval. And then each face image is sored with its association rules in the association rules database to be used in face image recognition and retrieval systems. Where using canny edge detection in moment invariant. In this paper the features vector that represent the face features consists of seven features. The proposed system tested on dataset consists of 300 images for 30 persons for each person 15 images in different lighting conditions, varied in expression, orientations, illumination, skin color, background, ages, and faces shapes (the mouth and eyes are open or closed, with or without glasses, male and female... etc.). The achieved training rate was 100% and recognition rate 84.3% and the average of precision 82%.

Index Terms— Face Recognition, Android Operating System, Moment Invariant, Data Mining, Association Rules.

1 INTRODUCTION

Face recognition has become a very effective research field in recent years, fundamentally paid by its wide applications such as in human-computer interaction, financial security and public security [1]. Face recognition is one example of biometric and it is use the character of the face to identify a person. Face recognition has drawn attention in computer vision at 1970 and the rest time the system of face recognition used was at 2001 for the purpose of reducing the crimes [2].
Biometric based techniques are essentially pattern recognition applications that acquire certain biometric attributes from an individual, extract a salient feature set from that attributes, compare this feature set against the feature set(s) enrolled in the database, and finally produce a final decision that based on the result of the comparison. A generic biometric system can be viewed as having four main modules: sensor, quality assessment and feature extraction, matching and a database [3].

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2 FACE DETECTION PROCESS IN ANDROID OPERATING SYSTEM

2.1 Android Operating System

The term "Android" is derived originally from a Greek word "andr-", which means "male or man" and the suffix "- eides", which means “of the species or alike”. These two words together means as much as “human being”.

Android is a software package for mobile phones that consists of a set of applications and programs or a set of system programs which form an entire system. This software platform provides a basis for applications that are fully similar to the real working platform [4]. Android is a S/W environment and not a H/W platform, that includes an OS, built on Linux Kernel –based OS hosting the Dalvik virtual machine (DVM). The DVM runs Android applications as instances of the virtual machine (VM). Android contains a rich user interface, application framework, JAVA class libraries and multimedia support [5].

2.2 Face Detction

The first and the most essential part of any automatic face recognition technique is face detection. Many of the images faces take via device camera, the purpose is to find better match for offered image face. Using a pre-stored image face database, the face recognition system should be able to verify or identify one or more persons. Before face recognition is complete the system must decide if or not there is a face in a given image. This procedure is called face detection (FD) [6].

2.3 Detection Proposed

In this work the face is found by using one of algorithms android for detection face area. Fig 1. Presents sample of face detection representation.

Once a Face is detected; face area must be separated for the face recognition. In this work face image is taken directly from the android device and processed for the detection of the necessary areas, namely face detection process. In android, the face detection process is done by activating the existing function of the android library. Our proposed represent faces by coordinates of the eyes distance and the face midpoint. Because first, this representation looks to be more appropriate in the terms of the results comparison; second, experts mark eyes faster, easier and more precisely than they mark faces by rectangles. After get the coordinates for the face detection, next phase is the cropping process. The cropping process is done by cutting the face detection area.

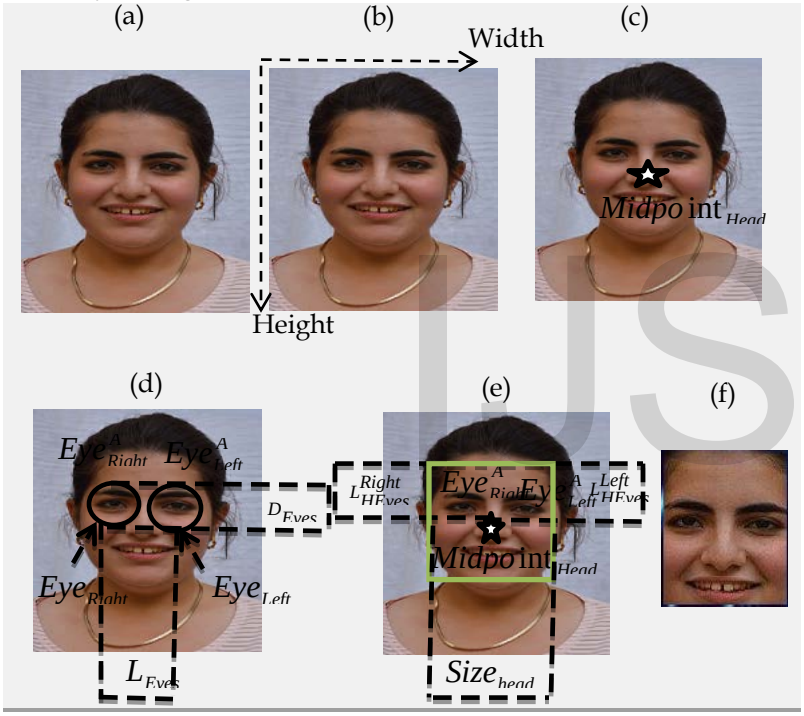


Fig.1. face detection representation
(a) Original face image (b) height and width image
(c) Center head (d) distance between eyes
(e) Rectangle area (bounding box) (f) face clip

3 DATA MINING

Data comes is, possibly, from many sources. It is integrated and placed in some common data store. Part of it is then taken and pre-processed into a standard format. This 'prepared data' is then passed to a Data Mining (DM) algorithm and this produces an output in the form of rules or some other kinds of 'patterns' [7]. Gold mining is a process for sifting through lots of earth to find valuable nuggets. Data mining is a process for mining through lots of data to find useful information that aids in decision making. Better data means better results, there are limited ways you can improve your result from data mining, and better data is one. Better data means you can build more comprehensive and more accurate models. Data mining requires huge amount of data and that means more sources of data but not all data is useful for discovering knowledge or association rules. An association rule is a rule, which implies certain association relationships among a set of objects in the database. The discovering of association rule is an important data-mining problem since the database to mind is often very large (measured in gigabyte and even terabytes) [8].

4 ASSOCIARION RULES PROBLEM

A formal statement of the association rule is:

Definition 1: Let I = {I1, I2, …, Im} be a set of m distinct attributes, also called literals. Let D be a database, where each record (tuple) T has a unique identifier, and contains a set of items such that $T \subseteq I$ An association rule is an implication of the form $X \Rightarrow Y$, where X, $Y \subset I$, are sets of items called item sets, and $X \bigcap Y = \Phi$. Here, X is called antecedent, and Y consequent. Two important measures for association rules support (s) and confidence (c), can be defined as follows [9].

Definition 2: The support (s) of an association rule is the ratio (in percent) of the records that contain $X \bigcup Y$ to the total number of records in the database. Therefore, if the support of a rule is 5% then it means that 5% of the total records contain $X \bigcup Y$. Support is the statistical significance of an association rule [10, 8].

$$Support(X \Rightarrow Y) = P(X \bigcup Y) \quad (1)$$

$$Support(X \Rightarrow Y) = frequent(X \Rightarrow Y) / (total\ number\ of\ records\ in\ DB) \quad (2)$$

Definition 3: For a given number of records, confidence (c) is the ratio (in percent) of the number of records that contain $X \bigcup Y$ to the number of records that contain X. Thus, if a rule has a confidence of 85%, it means that 85% of the records containing X also contain Y. The confidence of a rule indicates the degree of correlation in the dataset between X and Y. Confidence is a measure of a rule's strength. Often a large confidence is required for association rules [10, 11].

$$Confidence(X \Rightarrow Y) = (frequent(X \bigcup Y)) / (frequent(x)) \quad (3)$$

Definition 4: The Itemset is a collection of one or more items in a market based transactions. Consider a set of literals I = {i1, i2, ..., im} then I is called itemset [12].

Definition 5: Itemsets with minimum support (minsup) and minimum confidence (minconf) are called as large itemsets or frequent itemsets, while others that do not cross minimum support and minimum confidence values are known as small itemsets [12].

Definition 6: An itemset that contains k items is a k-itemset [13].

Definition 7: The candidate Itemsets is a set of itemsets which are generated from a seed of itemsets which were found to be large in the previous pass. Large itemsets for the next iteration are selected from the candidate itemsets if the support of the candidate itemsets is equal to or larger than minimum support and minimum confidence [12].

5 PROPOSED SYSTEM

The main idea of the proposed system depends on the fact that any face image person has multi unique features. These features are different from one face image to another.

In this paper, its try to propose an algorithms to extract features from the face image person to find association rules between these features to recognition and retrieve face images person. So this paper uses feature extractions based on seven moments invariant where using edge detection in moment invariant.

Also proposed content based Image Retrieval (CBIR) system that supports querying by example to retrieve similar face images from a database depends on the visual content of face images. All the features extracted from the training face images are stored into database features and then used to choose the closest one to the requested face image. The retrieved images are ranked according to some calculated similarity by applying best match association rules technique.

5.1 Training Phase

5.1.1 Edge Detection Stage

The main purpose of this stage is to detect the main edge in face image. This stage includes three steps, image smoothing, convert to gray- scale and applying canny edge detection.

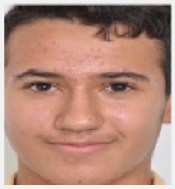
Step1 Face Image Smoothing

After stage face detection in android system, first stage in edge detection is image smoothing. The purpose of this stage is to reduce the existing noise and improve the shape of face details. Gaussian filter [14] as expressed in equation (4) is used in this step of proposed system.

$$f(x,y) = \frac{1}{2\pi\sigma^2}\exp(-\frac{x^2+y^2}{2\sigma 2}) \quad (4)$$

In the Figure (2), explains application of Gaussian filter with kernel size (3x3) and sigma value (0.8) with its array value that are produced for case. The smoothing step is processed to achieve better edge extraction results.

Face clip



Sigma 0.8

Kernel Size

001	002	001
002	005	002
001	002	001

Fig.2. explains the applying of Gaussian filter with sigma value

Step2 Convert to Gray Scale

The colored image of face will transform to gray scale .each colored input will convert to gray scale image (this operation will convert 24-bit/pixel images to 256 gray scale image), the equation (5) is used in this step of proposed system .

$$f(x,y)=Thresholds(R/255+G/255+B/255) \quad (5)$$

In the Figure (3) show explains the result of applying threshold value in the range (127) with the sigma value equal to (0.8) of Gaussian filter to obtain best results.

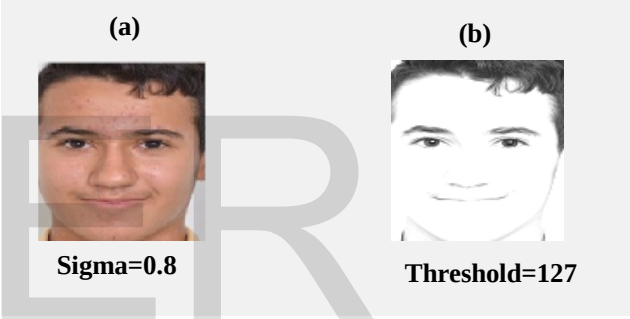
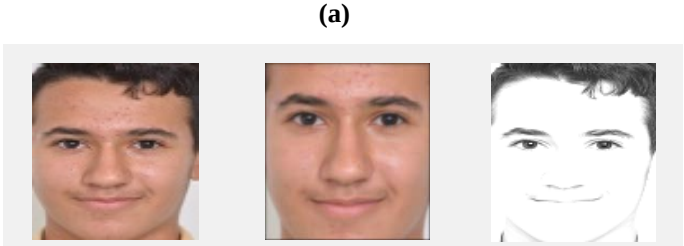


Fig.3. An example of result of applying thresholds:
(a)Face Clip after Gaussian filter
(b)Face Clip after converting to Gray-Scale

Step3 Canny Edge Detection

The motivation behind edge detection in general is to significantly reduce the amount of data in an image, while protecting the main structure to be utilized for further image processing [15].

In The Figure (4) explains applying canny filter after (image smoothing step and convert it to Grayscale step) with maximum and minimum thresholds values (T Max is 20 and T min is 100).



(b)

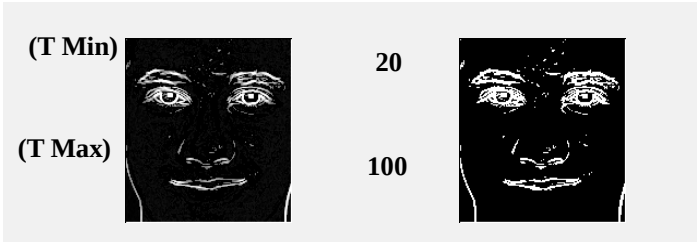


Fig.4. An example of applying canny filter:
(a) The steps before applying canny filter
(b) After applying canny filter

5.1.2Moment Invariants

This technique has been widely applied to image pattern recognition in a diversity of applications because of their invariant features on image scaling, rotation and translation. Moment invariants are useful for calculating sets of region properties that can be used for shape recognition. The two dimensional geometric moments of order $(p+q)$ of a function f(x,y) are defined in equation (6) [16]:

$$m_{pq} = \sum_{x=0}^{x=N-1} \sum_{y=0}^{y=M-1} x^p y^q f(x,y) \quad (6)$$

Where
p, q=0,1,2,…….∞
N: the number of columns
M: the number of rows.

The moments that have the property of translation invariance are called central moments and are denoted by μ_{pq}, they are defined as in equation (7):

$$u_{pq} = \sum_{x=0}^{x=N-1} \sum_{y=0}^{y=M-1} \left(x-\bar{x}\right)^p .\left(y-\bar{y}\right)^q f(x,y) \quad (7)$$

Where $\bar{x}$ and $\bar{y}$ the coordinates of the centered and they are calculated using (8) and (9) [16].

$$\bar{x} = \frac{m_{10}}{m_{00}} \quad (8)$$

$$\bar{y} = \frac{m_{01}}{m_{00}} \quad (9)$$

It can be easily verified that the central moments up to the order $p+q \le 3$ may be computed by the following formulas and equations (10) - (11) [17]:

$$u_{00} = m_{00} \quad (10)$$
$$u_{10} = 0$$
$$u_{01} = 0$$
$$u_{20} = m_{20} - \bar{x}m_{10}$$
$$u_{02} = m_{02} - \bar{y}m_{01}$$
$$u_{11} = m_{11} - \bar{y}m_{10}$$
$$u_{30} = m_{30} - 3\bar{x}m_{20} + 2\bar{x}^2 m_{10}$$
$$u_{12} = m_{12} - 2\bar{y}m_{11} - \bar{x}m_{02} + 2\bar{y}^2 m_{10}$$
$$u_{21} = m_{21} - 2\bar{x}m_{11} - \bar{y}m_{20} + 2\bar{y}^2 m_{01}$$
$$u_{03} = m_{03} - 3\bar{y}m_{02} + 2\bar{y}^2 m_{01} \quad (11)$$

Scale invariance can be obtained by using normalized central moments η_{pq}, as equations (12) and (13) [16].

$$\eta_{pq} = \frac{\mu_{pq}}{\mu_{00}^{\gamma}} \quad (12)$$

Where

$$\gamma = \left[\frac{(p+q)}{2}\right] + 1 \quad (13)$$

A seven non-linear absolute moment invariants, calculated from normalizing central moments through order three are given as equations (14) to (20) [16]:

$$\phi_1 = \eta_{20} + \eta_{02} \quad (14)$$
$$\phi_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2$$
$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2$$
$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$
$$\phi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})$$
$$\left[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2\right]$$
$$+ (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})$$
$$\left[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right]$$
$$\phi_6 = (\eta_{20} - \eta_{02})$$
$$\left[(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$

$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})\left[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2\right] + (3\eta_{12} - \eta_{30})(\eta_{21} + \eta_{03})\left[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right] \quad (20)$$

5.2Training Database Features (TRDBF)

The extracted features from gray scale face image by using canny edge detection in moment invariant are stored in database which is called (TRDBF). This database includes (5) attributes for features (five moment invariants) and another one for class and have n orientations for each face image. Table (1) illustrates (TRDBF) structure with one image data.

TABLE (1)
TRDBF STRUCTURE

Class	Features						
	Image	A	B	C	D	E	F	G
C1	C1-1	0	0.0976	0.1925	0	0.8132	1	0.7753
	C1-2	1	0	0.1276	1	0.0577	0.8048	0.6824
	C1-3	0.3837	0.0612	0.2589	0.3697	0.0395	0.7171	1
	C1-4	0.6183	1	0	0.1888	1	0.9083	0.7918
	C1-5	0.458	0.3678	1	0.6353	0	0	0

5.3 Extraction Association Rules

Extracted association rules for the face image represent the core of the process of the proposed algorithm.

5.3.1 Association Rules Quantity (ARQ)

ARQ algorithm depends on A-priori algorithm with idea of minimum quantities support (MQS) and quantity confidence while A-priori depends on a number of frequencies and confidence must be 100%. Algorithm (1) illustrates the steps of Association Rules Quantity (ARQ).

Algorithm (1) Association Rules Quantity (ARQ)
Input: Texture information features for image face
Output: Extract Association Rules
Step 1: Compute the total quantity for each 1-itemset.
Step 2: Compute total quantity for all itemset.
Step 3: Compute Minimum Quantity Support (MQS) by using equation (21) for each 1-itemset, L1 [18].

$$MQS = \frac{Quantity\ (1-itemset)}{Total\ Quantity\ of\ items} \quad (21)$$

Step 4: Determine the threshold of quantities from the lower value of MQS
Step 5: Construct K-itemset from (k-1)- itemset for each k =2 to itemset number and for MQS>= threshold quantity
Step 6: Extract Association Rules for each confidence=100% by using equation (22) [18].

$$Quantityconfidence = \frac{Quantity\ (k-itemset)}{Quantity\ ((K-1)-itemset)} * 100 \quad (22)$$

Step 8: End.
Step 7: Store resulting Association Rules in Association Rules database.
Step 8: End.

5.3.2 Association Rule DB with Face Image ID

The association rules stored correspond to its face image in Face image association rules Extracted database (FIAEDB) which has structure as shown in table (2).

TABLE (2)
EXAMPLE OF ASSOCIATION RULES EXTRACTED DATABASE (FI-AEDB)

Association rules	Face Image Path
AF-->G, AG-->F, E-->FG, EF-->G, EG-->F, A-->D, D-->A, A-->F, A-->G, E-->F, E-->G, F-->G, G-->F, A-->FG	

6 TEST PHASE

Given a test image, the system applies the same process to the training phase image to obtain the Association rules. Our implementation is based on the test by example for matching. Test image fed to the features extraction to extract the test features and then extract Association rules that is used for recognition process, this is done using a dedicated GUI.

7 QUERY PHASE

Given a query image, the system applies the same process to the training phase to obtain the Association rules. Our implementation is based on the query by example for matching. Query image fed to the features extraction to extract the query features and then extract Association rules that is used later for retrieval process, this is done using a dedicated GUI, which is proposed to simplify the interaction process between the user and CBIR system.

8 RETRIEVAL PHASE

This part is concerned with retrieving the most 10 similar images listed in the database to the user's query image according to their Association Rules. Retrieval part depends on two steps Similarity Association Rules and Image Fetching.

- Similarity Association Rules

This step is used to compute the distances between the user's query image Association Rules and Association Rules for all images in the database to find nearest images.

- Image Fetching

Image Fetching is responsible for fetching the image due to its corresponding path and then displaying nearest 10 images.

9 DATASET

The dataset that collected from 30 volunteers of different samples; 10 samples for each person, the images were taken under different lighting conditions, varied in expression, orientations, illumination, skin color, background, ages, and faces shapes (the mouth and eyes are open or closed, with or without glasses, male and female... etc), the face is in frontal position. The face images are 24 bit RGB, 300x400 pixels resolution of (BMP) format. For training purpose, training face image set which refers to a set of entire face image is extracted from the dataset to be used for extract association rules, the training set are used to generate training pattern set, five samples for each person is used (frontal view). Test face image set, refers to a set of entire samples extracted from the dataset to be used for generate testing pattern set, ten samples for each person are used. Retrieval face image set, refers to a set of entire samples extracted from the dataset to be used for generate query pattern set; fifteen samples for each person are used for training, ten samples for each person are used for query. So, the total number of face samples in the dataset is 300 (30*15).

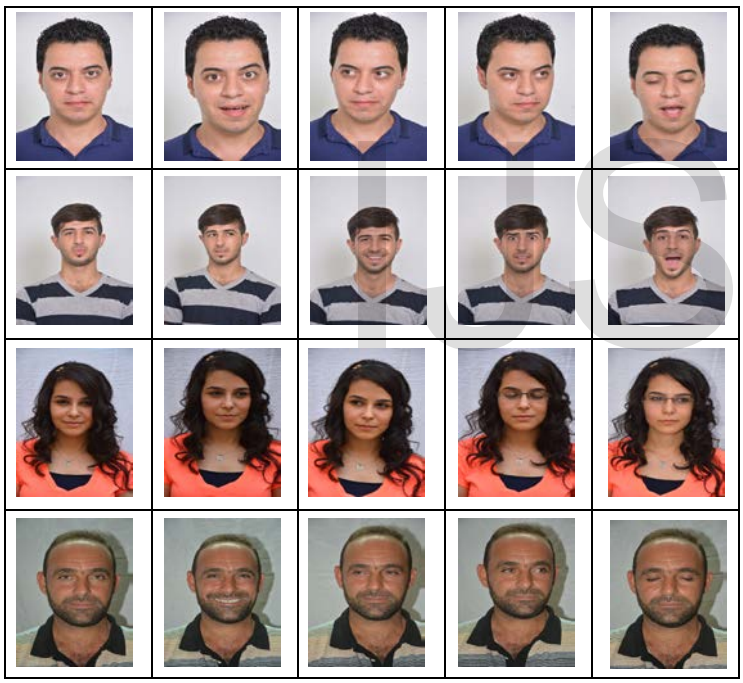


Fig.5. some face images chooses from the database

10 EVALUATION CRITERIA

The evaluating performance of face recognition system is calculated by two measures called False Alarm Rate (FAR) and Recognition Rate (RR). The formula for calculating these measures are given as in equations (23) and (24) respectively [19].

- **False Alarm Rate (FAR):** is defined as the ratio between the numbers of false recognition decision to the total number of attempts.

$$FAR = \frac{\text{Number of false recognition attempts}}{\text{Total number of attempts}} * 100 \quad (23)$$

- **Recognition Rate (RR):** is defined as the ratio between the numbers of correct recognition decision to the total number of attempts.

$$RR = \frac{\text{Number of correct attempts}}{\text{Total number of attempts}} * 100 \quad (24)$$

The evaluating performance of face retrieval system is measures through how many face images for specific query are truly relevant to a query. The retrieval efficiency is generally evaluated through two well- known metrics, precision and recall. The formula for calculating these measures are given as in equations (25) and (26) respectively [20].

- **Precision:** is defined as the ratio between the numbers of retrieved images that are relevant to the number of retrieved images.

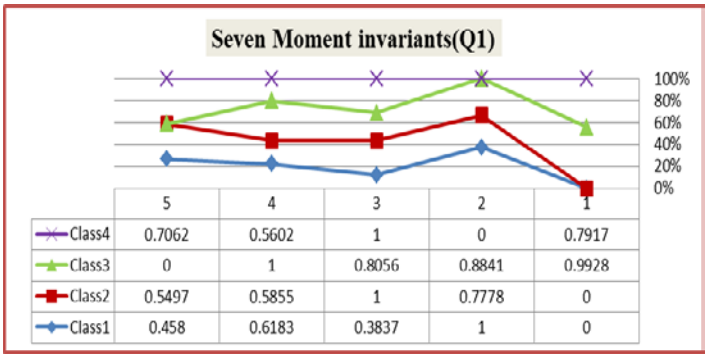
$$\text{Precision} = \frac{\text{No.Relevent Images Retrieved}}{\text{Total No.Images Retrieved}} \quad (25)$$

- **Recall:** is defined as the ratio between the numbers of retrieved images that are relevant to the total number of relevant images.

$$\text{Recall} = \frac{\text{No.Relevent Images Retrieved}}{\text{Total No.Images in the Collection}} \quad (26)$$

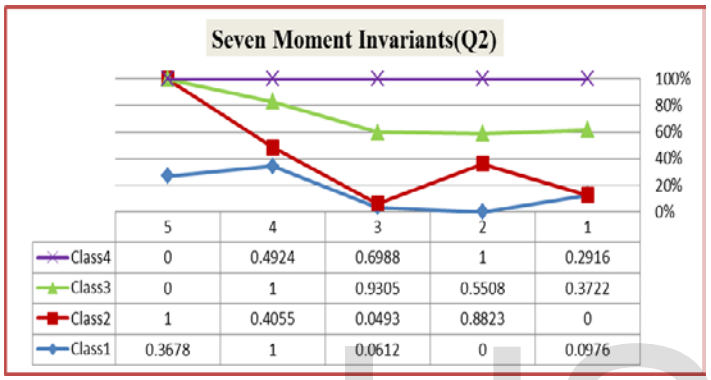
The feature vector for each person are obtained during the training phase and stored in the training database feature (TRDBF), each face image will apply all steps in training phases (detect face area, smoothing image by use Gaussian Filter where kernel size of Gaussian filter equal to (3x3) and its sigma equal to (0.8), threshold of gray scale equal to (127) and the values of maximum and minimum thresholds of canny filter are equal to (20) and (100), apply seven moment invariants).

The strong feature vectors for some sample classes are the following:



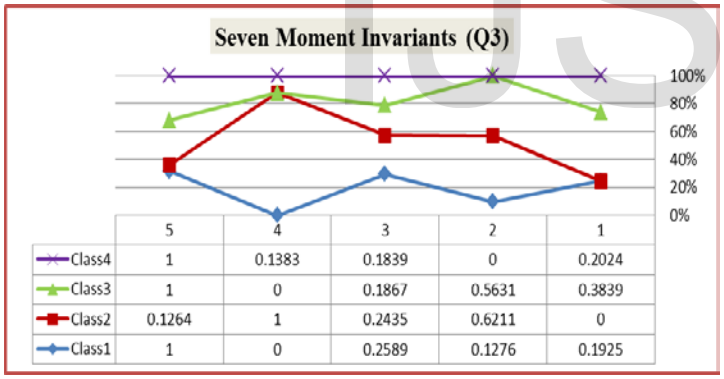
	5	4	3	2	1
Class4	0.7062	0.5602	1	0	0.7917
Class3	0	1	0.8056	0.8841	0.9928
Class2	0.5497	0.5855	1	0.7778	0
Class1	0.458	0.6183	0.3837	1	0

Fig.6. Comparison seven moment invariants (Q1) of some sample classes



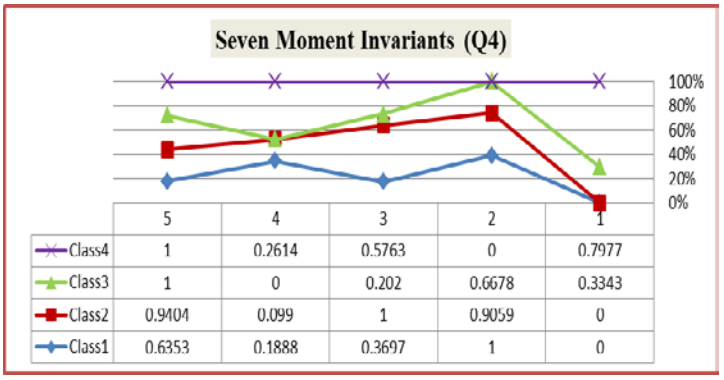
	5	4	3	2	1
Class4	0	0.4924	0.6988	1	0.2916
Class3	0	1	0.9305	0.5508	0.3722
Class2	1	0.4055	0.0493	0.8823	0
Class1	0.3678	1	0.0612	0	0.0976

Fig.7. Comparison seven moment invariants (Q2) of some sample classes



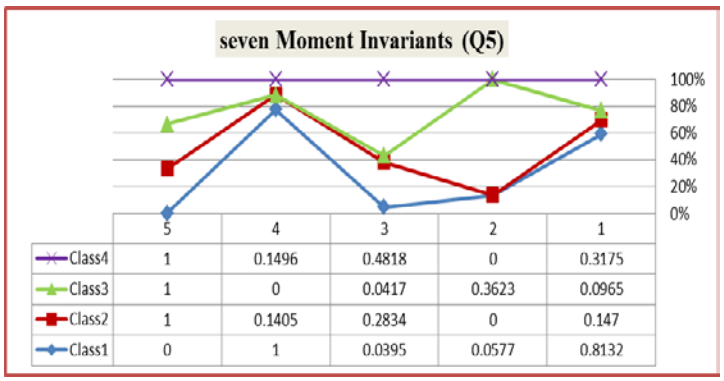
	5	4	3	2	1
Class4	1	0.1383	0.1839	0	0.2024
Class3	1	0	0.1867	0.5631	0.3839
Class2	0.1264	1	0.2435	0.6211	0
Class1	1	0	0.2589	0.1276	0.1925

Fig.8. Comparison seven moment invariants (Q3) of some sample classes



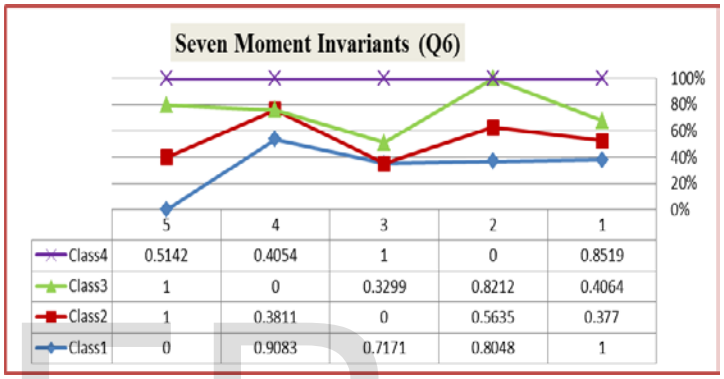
	5	4	3	2	1
Class4	1	0.2614	0.5763	0	0.7977
Class3	1	0	0.202	0.6678	0.3343
Class2	0.9404	0.099	1	0.9059	0
Class1	0.6353	0.1888	0.3697	1	0

Fig.9. Comparison seven moment invariants (Q4) of some sample classes



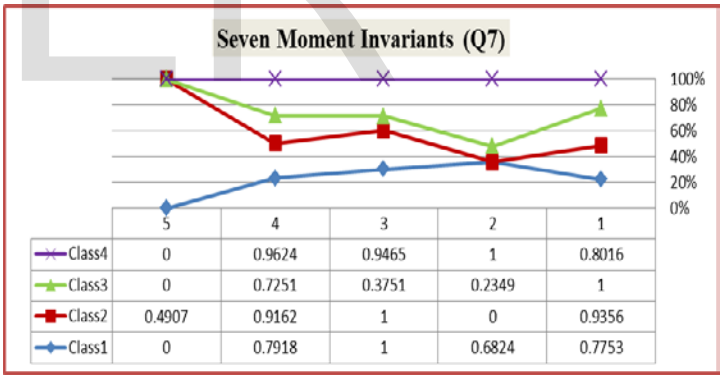
	5	4	3	2	1
Class4	1	0.1496	0.4818	0	0.3175
Class3	1	0	0.0417	0.3623	0.0965
Class2	1	0.1405	0.2834	0	0.147
Class1	0	1	0.0395	0.0577	0.8132

Fig.10. Comparison seven moment invariants (Q5) of some sample classes



	5	4	3	2	1
Class4	0.5142	0.4054	1	0	0.8519
Class3	1	0	0.3299	0.8212	0.4064
Class2	1	0.3811	0	0.5635	0.377
Class1	0	0.9083	0.7171	0.8048	1

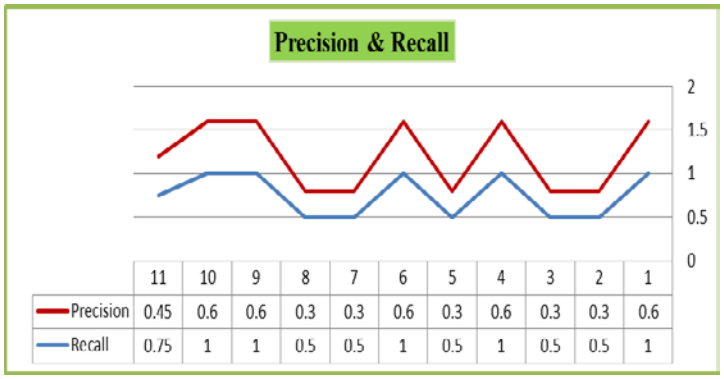
Fig.11.Comparison normalized central Moment (Q6) of some sample classes



	5	4	3	2	1
Class4	0	0.9624	0.9465	1	0.8016
Class3	0	0.7251	0.3751	0.2349	1
Class2	0.4907	0.9162	1	0	0.9356
Class1	0	0.7918	1	0.6824	0.7753

Fig.12. Comparison seven moment invariants (Q7) of some sample classes

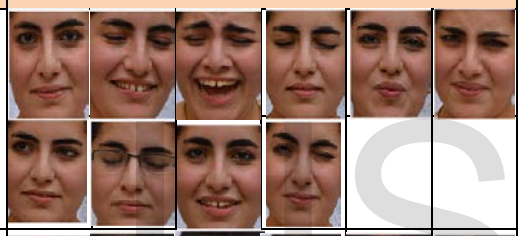
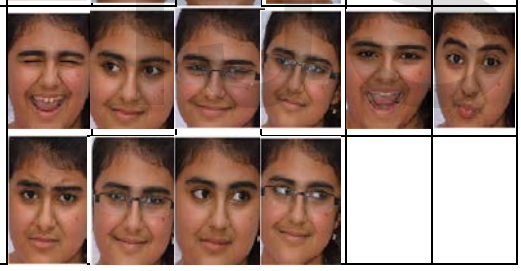
The experimentation this phase uses features which extract from the wavelet transform. The general average performance measures values (recall and precision) for moment invariants are the following:



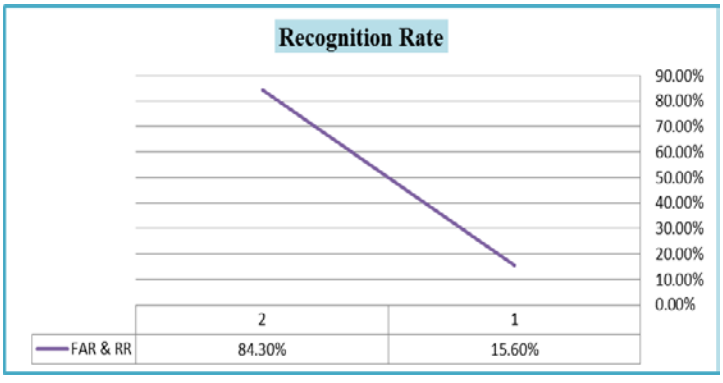
	11	10	9	8	7	6	5	4	3	2	1
Precision	0.45	0.6	0.6	0.3	0.3	0.6	0.3	0.6	0.3	0.3	0.6
Recall	0.75	1	1	0.5	0.5	1	0.5	1	0.5	0.5	1

Fig.13. Total General Average Performance Measure Values (Recall and Precision) When Using the Seven Moment Features.

TABLE (3)
A QUERY FACE IMAGE WITH THE RETRIEVED FACE IMAGE USING SEVEN MOMENT INVARIANTS

Query Face Image	Retrieval Face images
	
	

The recognition system measure based on moment invariants leads to the highest recognition rate. Fig.14. show FAR and Recognition rate values for feature extraction.



	2	1
FAR & RR	84.30%	15.60%

Fig.14. Show FAR and recognition rate based on seven Moment Invariants

11 CONCLUSION

Some important coclusions can be deawn from this work:

1. For Face detection process based on Android Operating System leads to higher detection performance results for most classes.
2. The proposed algorithm for extracting face clip shows the best result is; even though there are varied in expression, orientations, illumination, skin color, background, ages, and faces shapes.
3. Use canny edge detection to extract features leads to higher results. because use the values of control parameters are: Kernel size of Gaussian Filter equal to (3x3) and its sigma equal to (0.8), threshold of gray scale equal to (127) and finally the values of maximum and minimum thresholds of canny filter are equal to (20) and (100) in seven moment invariants.
4. Use of Association Rules to Recognition face image based on moment invariant leads to higher Recognition performance results because use face image shape, not affected translation, scaling and rotation because of the ground it is used to accelerate the point the feature and not depend on the point convergent but depends on all of the points.
5. Use of Association Rules to Retrieval face image based on moment invariant leads to higher Retrieval performance results.
6. The moment invariant used for feature extraction shows robustness because invariant features on image translation, scaling and rotation.
7. The work presented in this thesis achieves (84.3%) recognition rate for the moment invariant. Precision achieve for seven moment invariants (82%).

This work can be extended in different directions. In the followings some suggested ideas are given:

1. The Face Recognition system can be performed in Android Operating system.
2. It is possible to use another different of methods for extract features such as Moment color, Zernike moments and others in order to study the influences of Association Rules between them.
3. The proposed system can be improved by using other type of association rules algorithms based on Quantity such as FP-growth algorithm.
4. It is possible to use shape parameters (such as master eye Block, mouth block, nose block) and apply the same features extraction techniques to obtain better features that are fed ARQ to face Recognition and Retrieval.
5. Trying to use another types of Biometric technology such as (iris, fingerprint, voice…etc.).

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