University of Kasdi Merbah, Ouargla

Faculty of New Information and Communication Technologies

Department of Computer Science and Information Technology

Dissertation Submitted to the Department of Computer Science and Information Technology in Candidacy for the Degree of Master LMD in Fundamental .

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Title:

Ear Print Recognition Based On Local Texture Descriptors.

Publically defended: **date:07/03/2019**

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Academic Year : 2018 – 2019

The Summary

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General Introduction

General Introduction

In the light of developments and multiple uses of man in various fields transactions and services in their forms, which develops ways to identify and verify people for criminal investigation into a number of commercial applications. Traditional means of automatic recognition such as passwords or ID cards can be stolen, faked or forgotten Indeed. Thus there is an increasing interest in the electronic systems of identification and recognition.

the analysis of the behavior as well as in the analysis of the human morphology and studies, the biological variations of the people. This theme is situated in the general problem of the biometrics which is a science which suggests identifying the people from the measure of their biological indications. The biometrics recovers two main approaches:

behavioral analysis (speed of signature, walking …) or analysis of the human morphology (fingerprints, iris, ear, retina, voice, hand, face …)

The use of biometric techniques has to allow to identify a person through the according of a database, or to verify the identity asserted by an individual. We retained the modality "ear" because it is a biological very strong indication the technique ear recognition because we can use it at a distance without contact with the object. To use a camera allows to acquire the shape of ear of an individual and then to remove certain characteristics.

The first method is GLCM (Gray-Level Co-Occurrence Matrix), which is one of statistical methods the most used in the practice to measure the texture of the images. it makes The analysis of texture on the basis of the following measures : contrast, homogeneity, correlation and local homogeneity.

The second method is the technique LBP (Local Binary Pattern), which is a mathematical method the texture of an image of which its principle consists in characterizing by calculate of the code LBP for all the pixels of image and different the methods LBP.

We chose to articulate our study around three main chapters.

The first chapter is dedicated to the general presentation of the biometrics. It describes the principle of functioning of the biometric systems then, the representation of some modalities. Through this chapter, we want to position the problem of the recognition of ear and to present its stakes and interests compared with the other techniques. Finally, we have motioned some works relative to our theme of study.

In the second chapter, we evoked methods and techniques of ear. we focused on the most popular algorithms and on those the most adapted to our context of study. This chapter is divided into four.

In the first part we presented the algorithms of pretreatment, the smoothing and the division of the images which are used to prepare the image for the following stage.

In the second part we presented the features extraction methods, where we use both methods of LBP(LBP Basic and MultiScalLBP and Multi block ,Resize LBP), and the method GLCM. The third part presents the methods of classification, KNN (K Nearest Neighbors),ANN(Artificial Neural Network)Finally, the fourth part, we used calculate the Accuracy

In the fourth chapter, we presented the experimental results obtained by every method analyze their performances, followed by a discussion with interpretation of the results.

Finally, the general conclusion will summarize the results obtained by the various approaches.

Chapter I
Generalities of Biometrics

1. Introduction :

A Biometric systems are automated methods of recognizing or verifying the living person identity on the basis of some physiological or behavioral characteristics, the importance of biometrics in modern society has been reinforced by the need for large-scale identity management systems whose functionality relies on the accurate determination of an individual's identity in the context of several different applications. In this chapter we first, introduce some basic notions and definitions related to biometrics. We shall give the principle of functioning of the biometric systems as well as the tools used to measure their performances. We shall insist especially on the place of the ear recognition among the other biometric techniques, because it constitutes the objective of this theme.

2. The biometrics :

2.1. Definition of biometrics system :

The term Biometrics is derived from the Greek words "bio" (life) and "metrics" (to measure),first appeared in the 1970s as an automated technology. . It is a scientific and technological term, that allows the identification of people by relying on their physical or behavioral characteristics **[1][4].**

- **physical characteristics of person (people):**are defining features about their body as fingerprints, iris image, face, odor, retina, ear, vascular pattern, lips, hand geometry**…[2]**
- **behavioral characteristics of person:** the repeated activities we make in our daily life as speech, signature, keystroke dynamics, mouse dynamics, gait**…[2].**

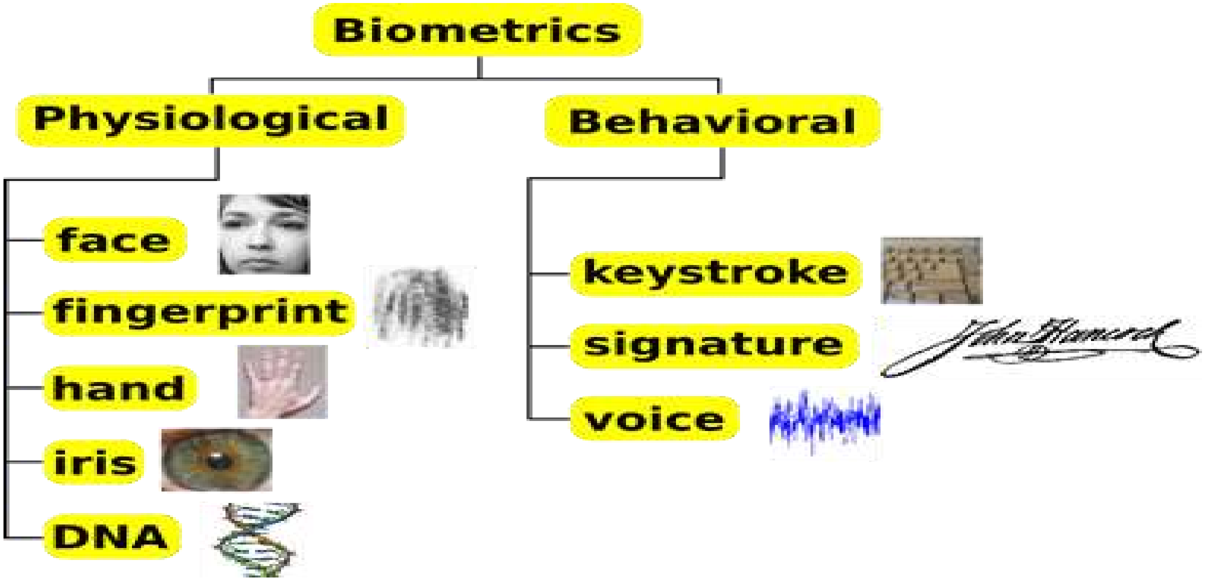

Figure I.1 : physical and behavioral characteristics.

2.2. Biometric Properties :

There are many criteria that must be accounted before a physical or behavioral trait can be considered suitable for use in biometrics. Perhaps the most important criteria are :

1. **Collectability** (the elements can be measured).
2. **Universality** (the element exists in all person).
3. **Permanence** (the property of the element remains constant over time).
4. **Acceptability**: (Society and general public should have no objection to provide the biometric characteristic).
5. **Circumvention**:(A biometric characteristic can be imitated or forged. By circumvention it is meant that the system should be able to handle these situations effectively).
6. **Uniqueness**: (No two persons should have the same value of the biometric characteristic i.e. it should be distinct across individuals) **[1]** .

2.3. Operating of biometrics :

Biometrics systems are operating in the modes below:

- **Enrollment**: storing the features in the database after, cleaning and noise removal in the collected data(processing**)[1].**

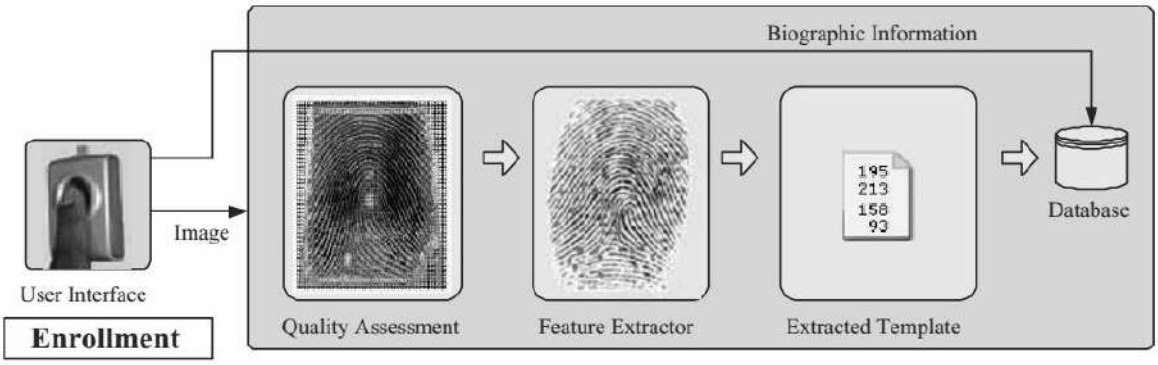

Figure I.2 : enrollment of data.

- **Verification:** is the process of comparing biometric data with already captured biometric data of the person that is stored in a system in order to validates her identity. we said that verification when the system asks and attempts to answer the question " is this ? ",Will need to answer with " YES" or "NO". this process generates a one to one match. **[2]**

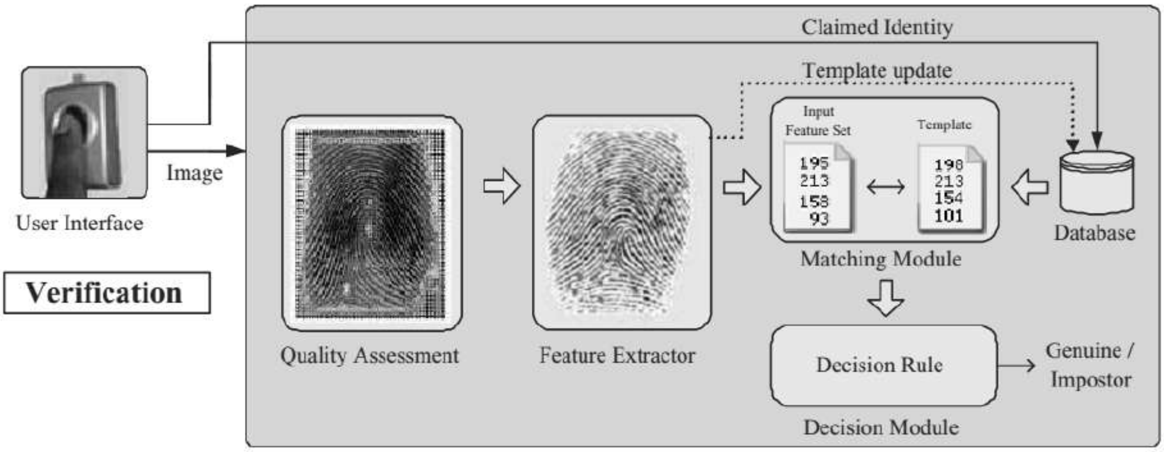

Figure I.3 : Verification of data.

- **Identification:** is more complex than verification process, process that compares a present person to a biometric database(data stock), it is when the system asks and attempts to answer the question, " Who is? ", generate a one to many matches. in the identification can be classified positive identification and negative identification whereas:

  - **positive identification :** images are interested to be identified by the system.
  - **negative identification** : images tries to avoid his/her successful identification by the system. **[2]**

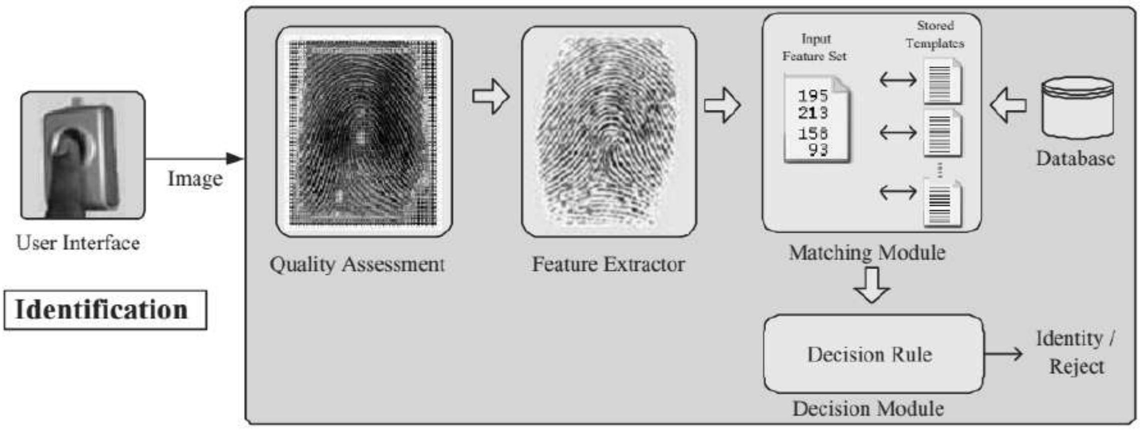

Figure I.4 : Identification of data.

2.4. Using biometrics (The advantages):

- Used to identify people.
- Easy-to-use.
- Passwords can be forgotten, shared, or observed; in the biometrics any person has her properties….**[3]**

2.5. Applications of biometrics:

The applications of biometrics can be divided into the following three

main groups :

- **Commercial applications :** medical records management , physical access control , distance learning , electronic data security…etc.
- **Forensic applications :** criminal investigation , corpse identification , parenthood determination and missing children… etc
- **Government applications :** national ID card , social security , passport control… etc

Figure I.5 : applications of biometrics systems .

2.6. Biometrics traits :

Multiple human properties (facial, eye, fingerprint, ear …….) use for identification. A brief introduction to some of the commonly used biometric characteristics is given below:

2.6.1. behavioral characteristics :

- **Voice** : Speech recognition can be defined as a system that recognizes words and phrases that are spoken. Voice identification has been derived from the basic principles of speech recognition **[5].**

Figure I.6 : Behavioral characteristics voice signal .

- **Signature** : is one of the most accepted methods of asserting ones identity. As we normally use it the signature is scrutinized as a static trace of pen on the paper **[5].**

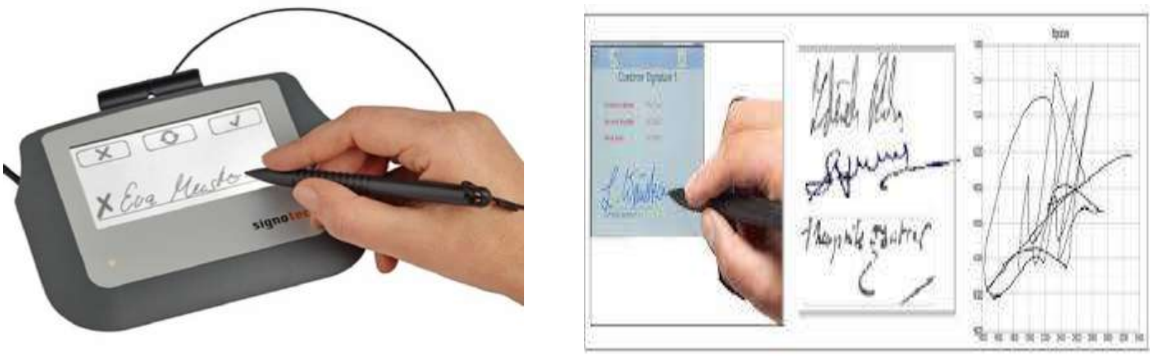

Figure I.7 : Behavioral characteristics Signature .

2.6.2. physical characteristics:

- **Face:** The human face plays an important role in our social Face images can be captured from a distance without touching the person being identified, A typical face recognition system starts with detection of the location of the face in the acquired image. From the detected face, distinguishing features are extracted. Features of a test image are compared with those of images stored in the database and decision is made based on the matching score against a threshold **[1].**

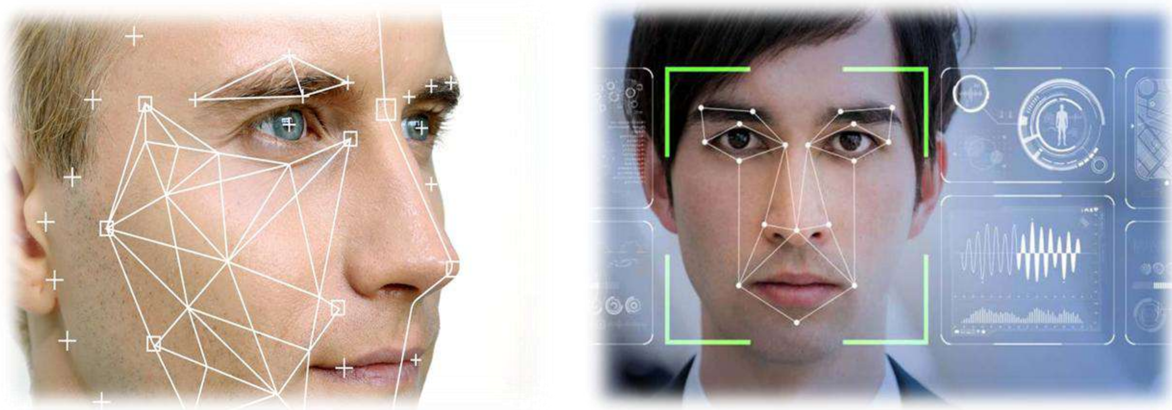

Figure I.8 : physical characteristics Face .

▶ **Iris :** The iris is the annular region of the eye bounded by the pupil and the sclera on either side. Each iris is unique, and even irises of identical twins are different. The complex structure of the iris carries distinctive information that is useful for identification of individuals. Iris scanning can be used quickly for both identification and verification Applications because of its large number of degrees of freedom **[3].**

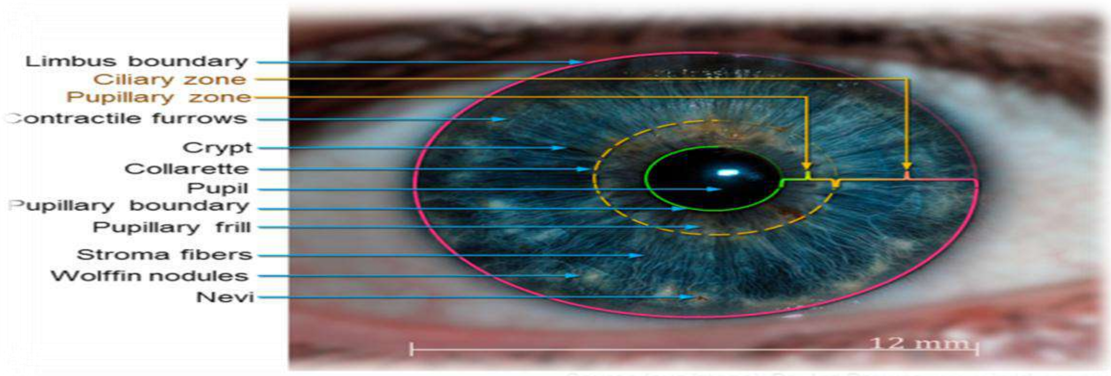

Figure I.9 : physical characteristics Iris .

- **Fingerprint :** Humans have used fingerprints for personal identification for many decades. A fingerprint pattern is composed of ridges and valleys. Ridges present various kinds of discontinuities which provide invariant and discriminatory information of a person. These points of discontinuities are called minutiae points and are used to recognize a person **[1].**

Figure I.10 : physical characteristics Fingerprint .

3.The ear Biometrics :

In the last years, several biometric technologies (fingerprints, iris image, face , speech, signature…) are considered mature enough to be a new tool for security, the ear-based person identification is one of these technologies. This technology provides a reliable, low cost and user-friendly viable solution for a range of access control applications **[6].**

Motivations of the ear recognition:

At the moment studies have given great attention the ear biometrics much popular are given Among these advantages :

1. The ear does not change its shape and color is uniform.
2. Easy access to ear because size large on the fingerprint and iris.
3. The ear data can be captured from a distance.
4. The ear shape is stable after the age of 8 years to the rest of his life.
5. Ear don't be affected by powders and lotions or nature like the sun **[4].**

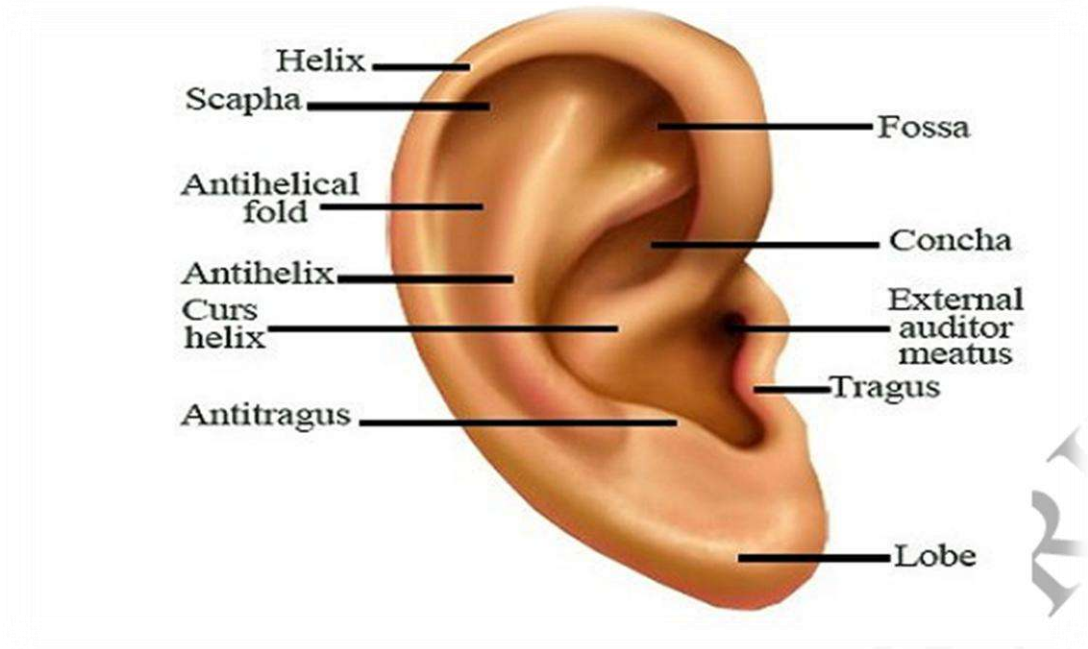

Figure I.11 : External structure of human ear .

When we choose to ear identify someone, we have to use two necessary steps: ear detection and recognition and alliterates two technologies 2D

Detection 2D: The technique of ear detection involves taking a picture of the profile and identifying the localization of the ear through the characteristics of the ear: and this technique is based on three firstly Profile face image undergoes a preprocessing phase before and Include skin region detection its Segmentation of non-skin areas in the face and removal of it who the treatment then Converts the color image to a gray scale image and splits the image with a white pixel for the skin areas and a black pixel for the non-skin areas with the binary image filter used to locate the ear. Followed by skin region edge Computation By aggregating pixels coordinates of image and then approximation of edge using line segments To represent the edge, you must remove the extra pixels from the edge and repeat the search for the deviation position from the edge points where each edge is split into linear parts, And last construction of convex edge map Having a noise like hair near the ear makes it un- convex and the edges can be classification into convex and non-convex edges and breakage non broken convex and , curvature based edge pruning . Second in technique ear candidate set generation its construction of edge connectivity graph and connected component computation ear candidate set computation and this Depends on distance measurements between two edges

Recognition 2D: The ear recognition system is based on techniques Image Enhancement and it minimize the effect of noise and impact of lighting and shadow. This techniques used image input ear to obtain three enhanced images. To optimize the image and get vector descriptors SURF feature, second Feature Extraction its Merge two features templates and matching SURF, it is applied between templates to find out the excess vector descriptor feature

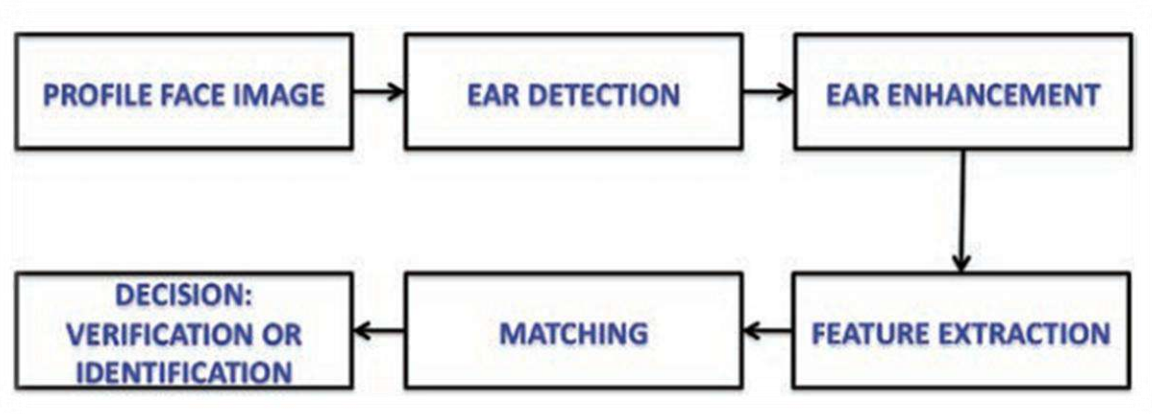

Figure I.12 : the block diagram of a typical ear Recognition system.

4.Related work:

Many approaches and researches have been proposed to extract features from human ear for the identification of peoples.

Zhichun Mu et. al [07] presented the edge-based ear recognition method including ear edge detection, feature extraction, recognition method and ear database construction. The database composed of 77 subjects, they used the Back Propagation network as classifier, the recognition accuracy was 85%.

Wang et. al [08] used Back Propagation neural network and moment invariants. Their database used was very small, it consisted of 60 images, and accuracy=91.8%.

Mohamad Mahmoud Al RAHHAL, M L MEKHALFI and M GUERMOUI [09] in its paper A Dense Phase Discriptor for Human Ear Recognition 2018 they proposed a novel descriptor for ear recognition namely, DLPQ (Dense Local Phase Quantization), which is generated using the LPQ (Local Phase Quantization) descriptor, the accuracy= 98.4%.

AnupamSana et. al [10] also presented ear biometrics system for human recognition, they use Haar wavelet transform, which was used to decompose the ear image. The decision was to matching one test image with n trained images, used two databases IITK and database created from Saugor University, India. The accuracy was 96%.

5. Conclusion:

In this chapter, we specked about biometric systems and, and various techniques of the biometrics then, we presented the general structure

of biometric system. Later, we noticed that the applications of biometrics and the performances of the biometric systems depend on several factors.

Then, we chose technique ear biometric among the other techniques, and identified the it’s important role in the biometrics recognition systems. Finally, we have mentioned some works which made previously and which have one relation with our work.

Chapter II

The Techniques Of Ear Recognition

1. Introduction:

Several ear recognition algorithms include some identification techniques. The directory identification method uses pixels, samples, models or textures as pattern. The popularity perform computes the variations between these options and therefore the hold on templates to use correlation or distance measures.

The main goal of this chapter is to implement and analyze the methods that enables recognition human ear .

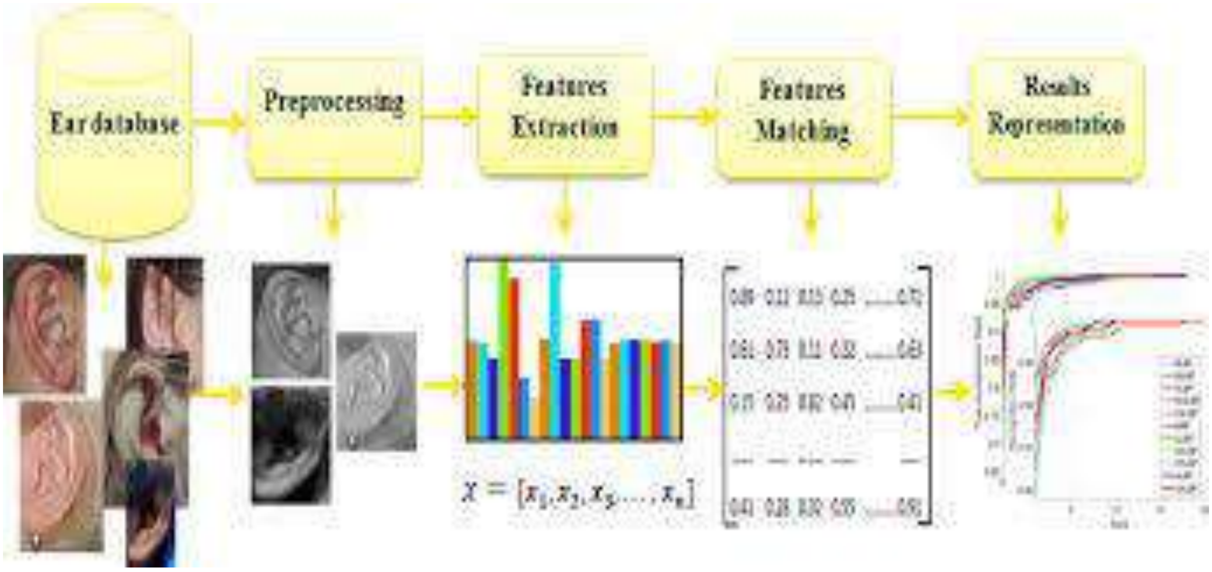

Figure II.1 :structure of ear recognition system.

2. The techniques of ear recognition:

2.1. Global Approaches:

The global methods are based on well known statistical analysis techniques. It is not necessary to locate certain characteristic points of ear. In these methods, the ear images (which can be seen as valuable matrices of pixels) are treated in a global way and are generally transformed in vector, easier to manipulate **[11]**.

2.2. Local Approaches:

Local approaches for ear recognition extract features from local areas of an image and use these features for recognition. It is do not rely on the locations of specific points or relations between them, but on the description of the local neighborhood (or area) of some points in the image. The points of interest to local approaches must not necessary correspond to structurally meaningful parts of the ear, but can in general represent **[11]**

3. Research Method :

The methods identified the image of a person in a system of ear recognition :

First, image is acquired which is then cropped and enhanced in preprocessing stage. Then, In feature extraction stage, wavelet is applied to get the main features of the ear. In the

matching stage, fast normalized cross correlation technique is used for the recognition of human.

3.1. Pre-processing:

Image preprocessing is an important component for ear identification systems. Pre-processing is done to segment out the ear image from the rest of the head portion of a person. Also, size normalization and ear image enhancement is the requirement of our proposed system before feature extraction. Each image is gone through the following steps before feature extraction.

- Ear image is cropped manually from the complete head image of a person.
- Cropped ear image is resized.
- Coloured image is converted to grayscale image.

3.1.1. The Smoothing :

The Smoothing is carried out by replacing each pixel by the average value with the neighboring pixel **[12].**

3.1.2. The Gaussian smoothing :

The Gaussian smoothing can be performed using standard convolution methods. The image has M rows and N columns, and the kernel has m rows and n columns. We use a suitable integer-valued convolution kernel that approximates a Gaussian with a σ of 1.**[11]**

$$g(x,y) = \frac{1}{2\pi\sigma^2} e^{\frac{x^2+y^2}{2\sigma^2}} \qquad \textbf{II.1}$$

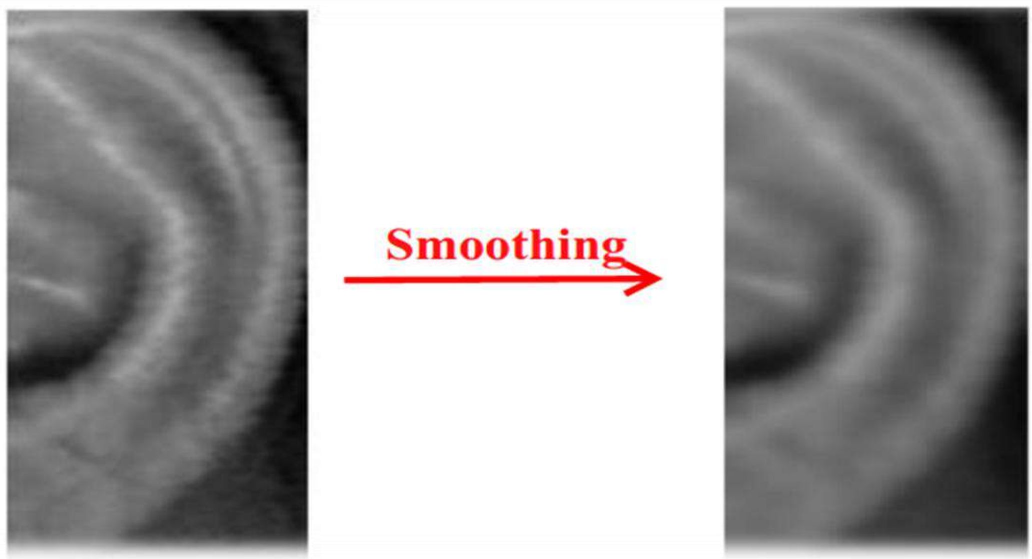

Figure II.2 : ear image before and after smoothing.

- **Normalization :**

Normalization of ear image is used to standardize the variation of gray levels, the structure of images does not change before the normalization. It's operation makes it possible to increase the contrasts in the images by making a certain adjustment to the gray levels represented in each pixel without affecting the useful information included in the ear image **[13].**

3.1.3. Image dividing :

This step consists in subdividing the departure image into square blocks of size N× N pixels, the objective is instead of extracting the characteristics of the image completely (less information) we will extract the features of every block, once we obtained histograms of blocks we concatenate them to form the final histogram of the image which is richer in information **[14].**

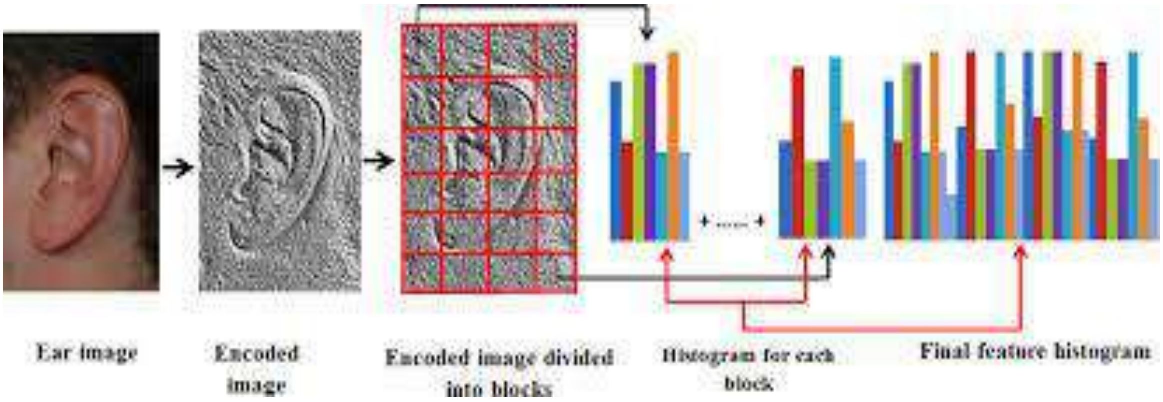

Figure II.3 : image divided into blocks.

3.2. Features Extractions:

feature extraction is one of the supreme steps in authentication of biometric system. It is the process of extracting feature of desired images from a large collection to be used in selection and classification task. It is used in selection and classification of task. It is used for dimension reduction and contains most of the information of the original image. Features are broadly classified as general features and domain specific features. General features are application independent feature like color, texture and shape **[15].**

3.2.1. GLCM method (Gray Level Co-occurrence Matrix):

Gray-level co-occurrence matrix (GLCM) is the statistical method of examining the textures that considers the spatial relationship of the pixels. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix **[19].**

3.2.1.1. **The steps to obtain GLCM of the image:**

- **Step 01: Quantization matrix:**
  - _ divide the 255 filds.
  - _ See each pixel content to which level it belongs.
  - _ Compensate all pixel content by level number.
- **Step 02: Spatial relationship matrix:**

Specifying the offsets : offset (a reference pixel and its immediate neighbor).

Each entry of the glcm (i,j) holds the cont of the number of times that pair of intensities appears in the matrice with the defined Spatial relationship.

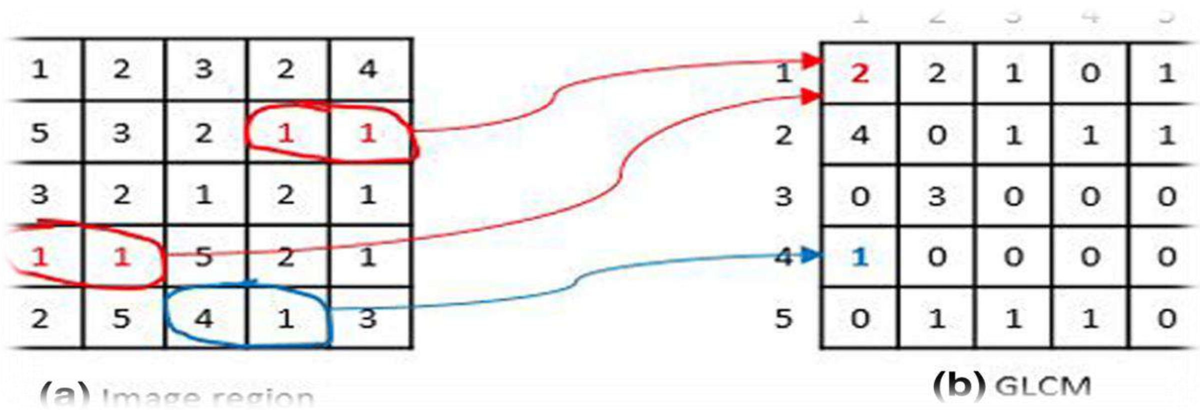

Figure II.4 : GLCM Matrix.

3.2.1.3. *Features of GLCM:*

There are 14 different measures proposed by Haralick in 1973,recall them:

where:

- **i** is the row number and **j** is the column number.

1. Normalization equation: $$\mathbf{P_{i,j}} = \frac{\mathbf{V_{i,j}}}{\sum_{\mathbf{i,j=0}}^{\mathbf{N-1}} \mathbf{V_{i,j}}} \qquad \textbf{II.2}$$

2. Contrast (this is also called "sum of squares variance" and occasionally "inertia"): $\sum_{i,j=0}^{N-1} P\,(i-j)^2$ **II.3**

3. Dissimilarity (Contrast Group):

$$\sum_{i,j=0}^{N-1} P\,|i-j| \qquad \textbf{II.4}$$

4. Homogeneity(Inverse Difference Moment) (Contrast group):

$$\sum_{i,j=0}^{N-1} \frac{P_{i,j}}{1+(i-j)^2} \qquad \textbf{II.5}$$

5. Angular Second Moment (ASM):

$$\sum_{i,j=0}^{N-1} {P_{i,j}}^2 \qquad \textbf{II.6}$$

6. Energy**:** $\boldsymbol{Energy} = \sqrt{\boldsymbol{ASM}}$ **II.7**

7. Entropy:

$$\sum_{i,j=0}^{N-1} P_{i,j}\left(-\ln P_{i,j}\right) \qquad \textbf{II.8}$$

8. GLCM Mean:

$$\mu_i = \sum_{i,j=0}^{N-1} i\left(P_{i,j}\right) \qquad \mu_j = \sum_{i,j=0}^{N-1} j\left(P_{i,j}\right) \quad \textbf{II.9}$$

9. Variance:

$$\sigma_i^{\,2} = \sum_{i,j=0}^{N-1} P_{i,j}(i-\mu)^2 \quad \sigma_j^{\,2} = \sum_{i,j=0}^{N-1} P_{i,j}(j-\mu)^2 \quad \textbf{II.10}$$

10. Correlation (Descriptive statistics group):

The Correlation texture measures the linear dependency of grey levels on those of neighboring pixels**.[21]**

$$\sum_{i,j=0}^{N-1} P_{i,j}\left[\frac{(i-\mu_i)(j-\mu_j)}{\sqrt{(\sigma_i^{\,2})(\sigma_j^{\,2})}}\right] \qquad \textbf{II.11}$$

3.2.2. Local Binary Pattern (LBP) :

Local binary (LBP) is a type of feature used for classification LBP was first described in 1994. The original LBP operator labels the pixels of an image by thresholding a 3 × 3 neighborhood of each pixel with the center value and considering the results as a binary code. The LBP code of the center pixel in the neighborhood is obtained by converting the binary code into a decimal one .use it improves the detection performance considerably on some datasets **[22].**

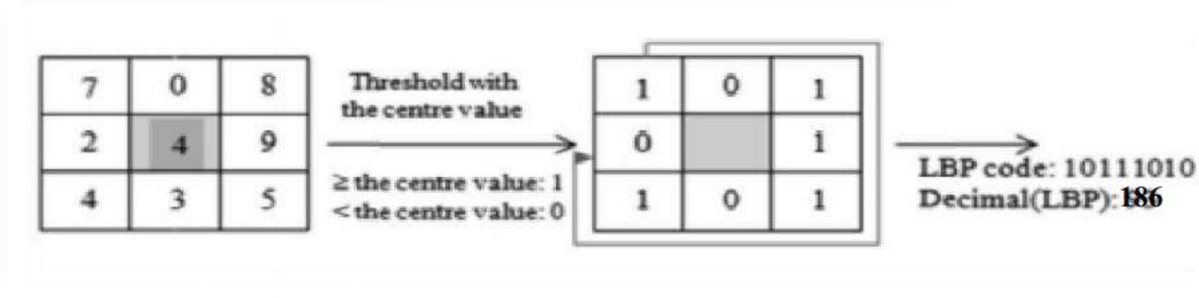

Figure II.5 : Local Binary Pattern (LBP basic)

3.2.3. Multi-scale Selected Local Binary pattern :

Multi-scale Selected Local Binary Features (MSLBF) predicates are proposed as an improvement to traditional LBP models for LBP-type classification. , which comprise individual point features from across multiple circular features at different scales. The selected features are treated as binary strings and converted to decimal values to represent individual samples, it reduces the computational time and complexity **[23]**

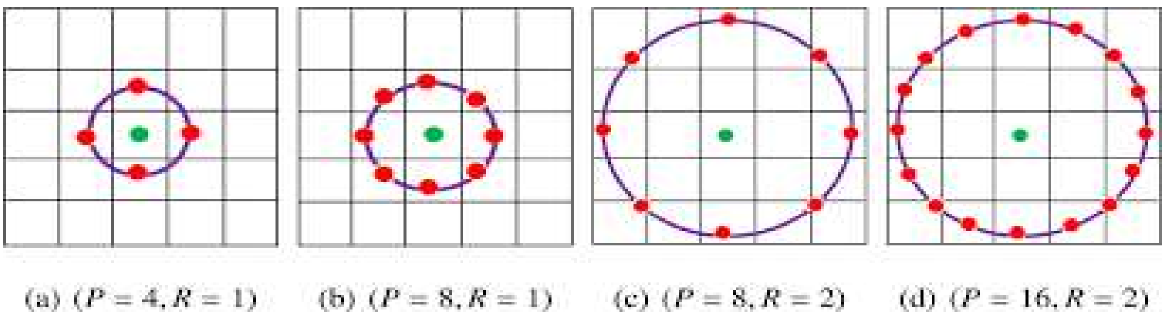

Figure II.6 : Multi-scale Selected Local Binary

3.2.4. Multi-block Local Binary (MB-LBP):

In this feature ,dividing image in the blocks . makes the LPB for each block .then take all LBP in the one vector .

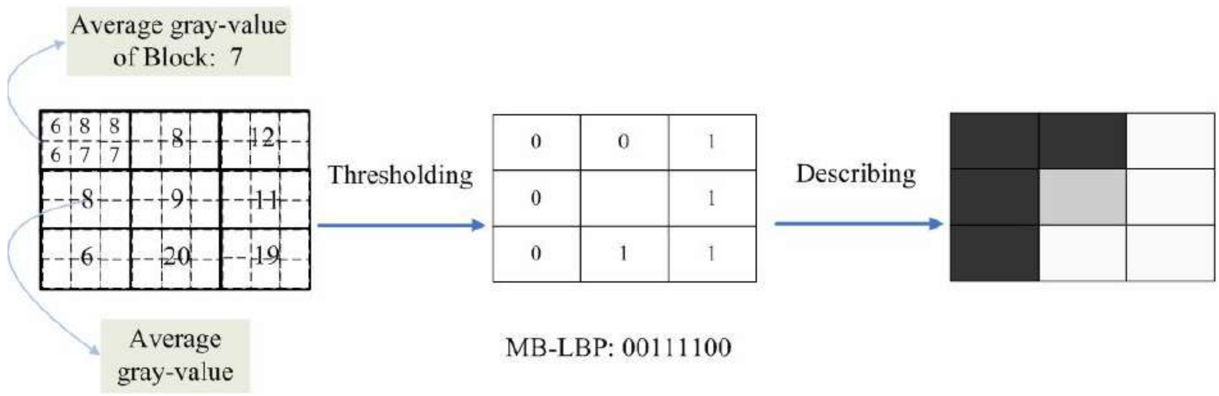

Figure II.7 : . Multi-block Local Binary (MB-LBP).

3.2.5. Image Resize Local Binary pattern :

Taking original image and after step pre-processing, calculated the LBP of original image , then changed her size twice or more , and recalculated LBP .take all LBP for different sizes then, make them in one vector.

4. The classification :

Classifications are used in different applications the pattern recognition is one of this applications . The classification is ability of assigning data (ear image) to one class from many predefined classes based on their features. It is finding a function or building a model (ANN, KNN, SVM,….) **[16].**

4.1. The classification by the method KNN (k-Nearest-Neighbors):

In pattern recognition, the KNN algorithm is a method for classifying objects based on closest training examples in the feature space. KNN is a type of instance-based learning, or lazy learning where the function is only approximated local (kNN) in which nearest neighbor is calculated on the basis of value of k, that specifies how many nearest neighbors are to be considered to define class of a sample data point , according to their distances from sample data point **[24].**

before KNN makes based on the outcome of the K neighbors closest to that point. Therefore, to make predictions with KNN, we need to define a metric for measuring the distance between the query point and cases from the examples sample. Choices to measure this distance Euclidean. Other measures include Euclidean **[25].**

Where:

- **X** is testing data.
- **Y** is training data.

- **Euclidean :** $\sqrt{\sum_{i=1}^{k}(x_i - y_i)^2}$ **II.12**
- **Cosine :** $\frac{x*y}{\sqrt{x*x}*\sqrt{y*y}}$ **II.13**
- **City-block :** $\sum_{i=1}^{K}|x_i - y_i|$ **II.14**

4.2. The classification by the method Artificial Neural Network (ANN) :

It is a method used to describe or find a linear relationship, this method work best if we treat us with non-linear data.

4.2.1. The ANN applications:

- **Classification :** the aim is to predict the class of an input vector.
- **Pattern matching:** the aim is to produce a pattern best associated with a given input vector.
- **Pattern completion** : the aim is to complete the missing parts of a given input vector.
- **Optimization:** the aim is to find the optimal values of parameters in an optimization problem.
- **Control :** an appropriate action is suggested based on given an input Vectors…..

4.2.2. Neural Networks training steps:

- **Weights initialization (W_i).**

Neural networks have the ability to synthesize nonlinear complex fonts and represent the optimal solution for problems related to automated learning. They have three layers

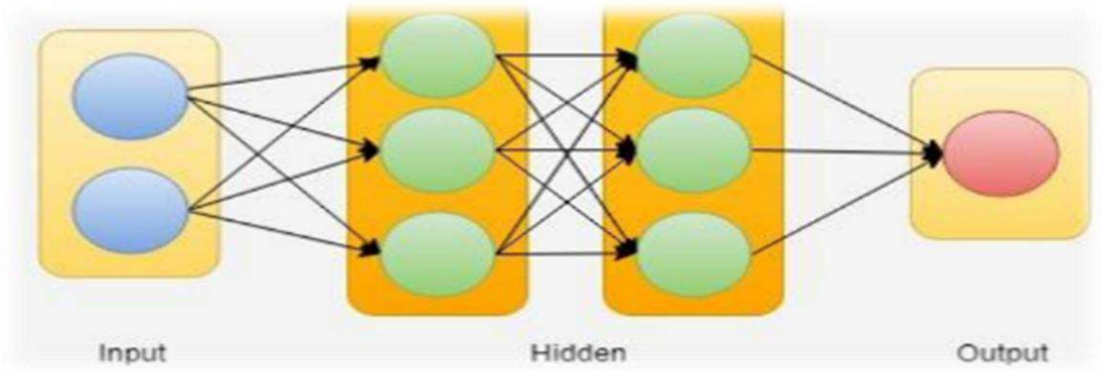

Figure II.10 : Neural Networks training steps:

1- Input Layers: This layer takes large volumes of data in the form of audio files, texts, numbers, image pixels, etc.
2- Hidden Layers: There can multiple hidden layers in a neural network. Hidden layers are responsible to perform mathematical operations, pattern analysis, feature extraction, etc.
3- Output Layer: This layer is responsible to generate the desired output **[26] .**

- **Input application (X_i).**
- **Sum of inputs and weights products** :

$$\text{Som} = \sum_{1}^{m} w_i * x_i + bais \qquad \textbf{II.15}$$

- **Activation function response calculation**

Activation function can be linear, threshold or sigmoid function. Sigmoid activation function is usually used for hidden layer because it combines nearly linear behavior, curvilinear behavior and nearly constant behavior depending on the input value Larose

- Piecemise linear $f(x) = \max(0, x) + \sum_1^s x(\max(0, -x + b)$ **II.16**
- Sigmoid $\sigma(z_j^i) = \frac{1}{1+\exp(-z_j^i)}$ **II.17**
- Signum $\sigma(z_j^i) = \begin{Bmatrix} -1, if z_j^i < 0 \\ 1, if z_j^i > 0 \end{Bmatrix}$ **II.18**

➢ **Weights adaptation**

$w(n+1) = w(n) + \eta[d(n) - y(n)]x(n)$ **II.19**

5. The Training and Matching module :

In training process, the numbers of training images are taken and then feature vector of each image is stored in the training database along with the average of the number of training images.

In the matching process, compares the currently extracted features against the stored templates to generate match **[17].**

6. The decision:

It is the step which makes the difference between an identification system of individuals and other one of check. In this step, an identification system consists in finding the model which corresponds best to the ear taken in input from those stored in the database, it is characterized by its

recognition rate. In other side, in a check system it is a question of deciding if the ear in input is well the one of the individual proclaimed or it is about a cheat **[14].**

▶ The Accuracy :

Accuracy is a qualitative performance characteristics, expressing the closeness of agreement between a measurement result and the value of the measure and . A quantitative estimate of the accuracy of a result is essential to define the degree of confidence that can be placed in it and the reliability of the decisions based on such result **[18].**

$$Accuracy = \frac{Number\ of\ Tests\ corresponding\ to\ a\ correct\ identification}{Total\ Number\ of\ Tests} \qquad \textbf{II.19}$$

7.Conclusion :

There are several of techniques ear recognition .In this chapter, we presented some algorithms of feature extraction images and classifications techniques of ear recognition , we presented this algorithms for clear evolution in the field of this biometrics, so allowing a real improvement of the performances.

Chapter III

Experimentations, Results and Discussion

1. Introduction :

In this chapter, we apply the methods described in chapter II. we opted for a validation on the basis of standard data IIT Delhi, for estimate the efficiency of this methods. the step of features extraction is the most important because the performances of the system depend on it results and robustness. We will estimate in this chapter the results obtained on the basis of data IITD under various conditions and methods attributes.

2. Experimental setup:

2.1. The database used:

A several databases containing information which allow the evaluation of the Systems of ear recognition are available. However, these databases are generally adapted to the needs for some specific algorithms of recognition; each of her was built with conditions of diverse acquisition of ear images, as well as the number of sessions for every individual **[27].**

2.2. IIT Delhi Ear database :

The IIT Delhi ear database contains 493 grayscale images of 125 subjects .Number of images per subject ranges from 3to 6. No major occlusions are present. Images were taken at different indoor lightning conditions and contain only subjects' right ears. All images were taken from the same profile angle. The database also contains normalized images (equal image dimensions, ears centered, tightly cropped and aligned with axes), but in our tests we used the default (non-normalized)images because this presents a bigger challenge and is closer to the images taken in the wild**.[28].**

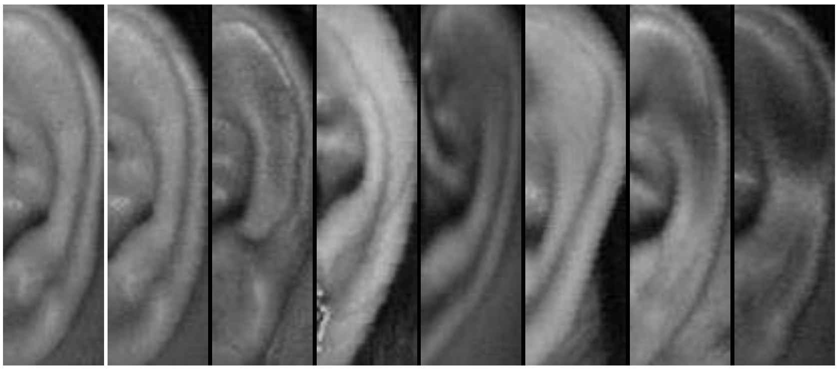

Figure III.1: Representative samples from IIT Delhi dataset (125 subjects)

2.3. Separation of databases:

To develop an application of ear recognition, it is necessary to have two databases: a base to make the training and another one to test techniques and determine their performances, but there is no rule to determine this division in a quantitative way. It often results from a compromise taking into account the number of data which we have and of time to make the training.

In the series of test that we made the base was split in the following way:

- **Test images :** the first image of every individual we served for the realization of the tests.
- **Training images:** the images which stay of every individual served for the phase of training. The purpose is to estimate the rate of recognition of various algorithms presented, by following a protocol of test based on the measure of recognition rate **[14].**

2.3.The language used (MATLAB R2013a):

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include

•Math and computation

• Algorithm development

• Data acquisition

• Modeling, simulation, and prototyping

• Data analysis, exploration, and visualization

• Scientific and engineering graphics

• Application development, including graphical user interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or Fortran.

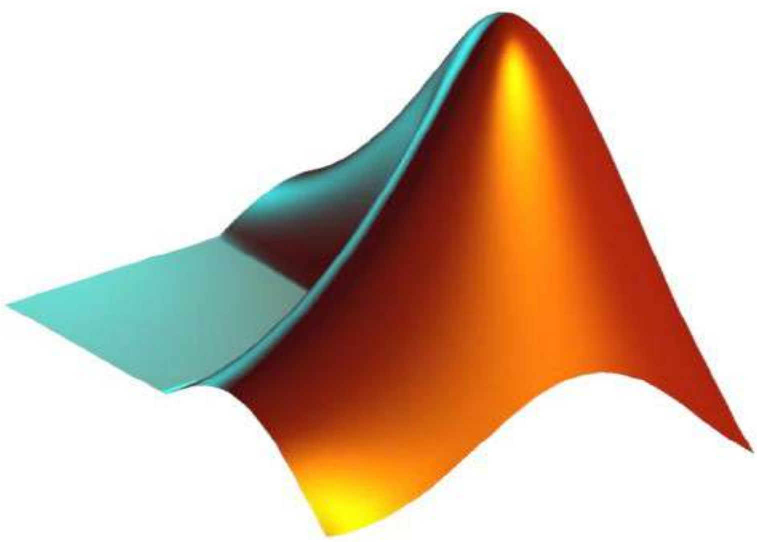

Figure III.2: The MATLAB logo.

3.Experimental results:

The following table makes the comparison of the various percentages of the classifiers accuracy for the five methods LBP basic, multi-scal LBP ,resize- LBP,MB- LBP and GLCM, for different distance (Euclidean, cosine, cityblock). in the case of the full images , where we observe that the classification using the method MB_LBP is the most successful followed by GLCM

	Classification_ KNN		
	Distance_Euclidean	**Distance_Cosine**	**Distance_Cityblock**
LBP (Basic)	49 %	48 %	55%
M-S_LBP	62 %	57 %	65.1 %
MB_LBP	82.67 %	84.67 %	87.47 %
Re-Size-im_LBP	50 %	49.5 %	57 %
GLCM	17 %	17 %	17 %

Table III.1: Comparison of the various percentages of the classifier (KNN) accuracy.

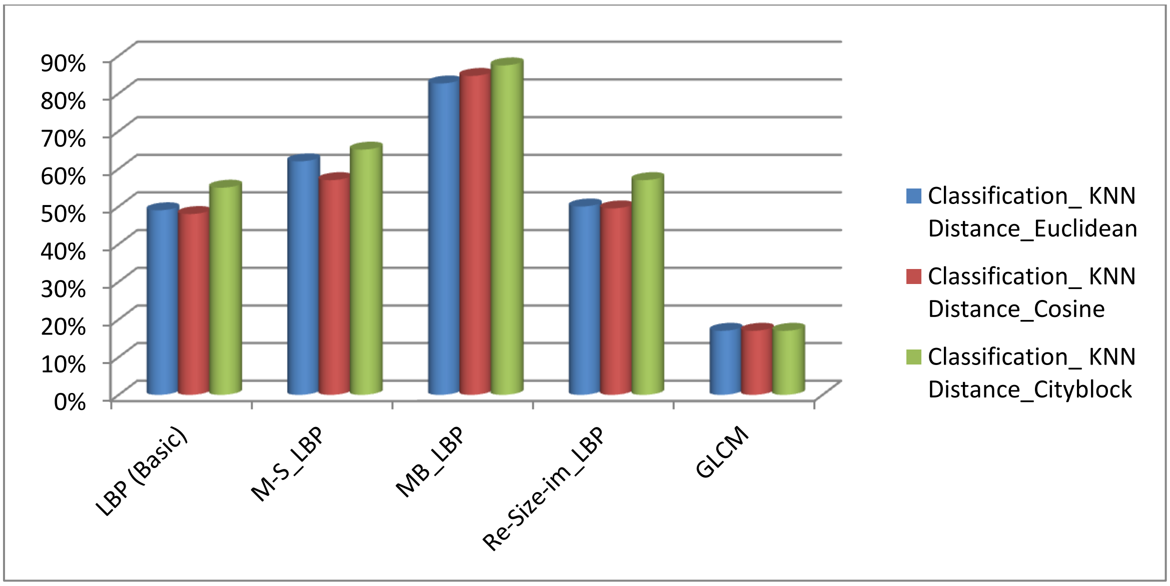

Figure III.3 : percentages of the classifier (KNN) accuracy.

4.Presentation of the application:

this figure, represented the interface of the project presentation, it is an interface intended for the

users, it is simple It contains two buttons:

Enter_System : to start the system .

About system : to information about who proposed the system .

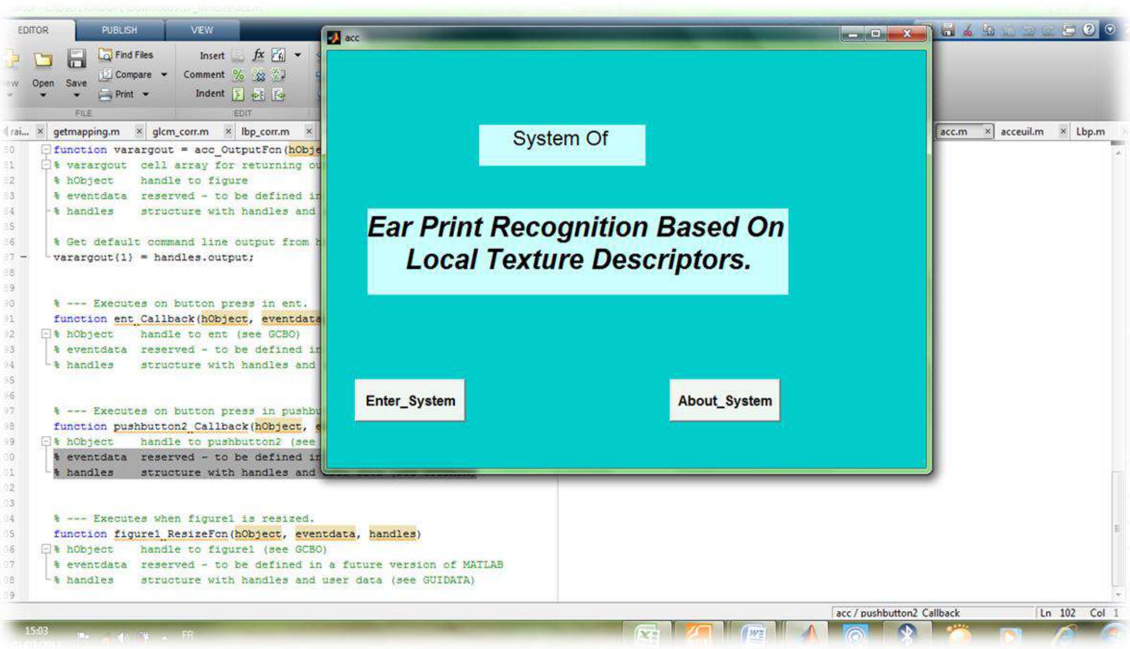

Figure III.4 : The interface of the project presentation.

In interface opens, it contains ten buttons, 'Browser image', 'three buttons of KNN the three destances', and ' KNN – Accuray ', ' ANN – Accuray ' pop up menu to Features_extraction', 'Exit' and 'Back'.

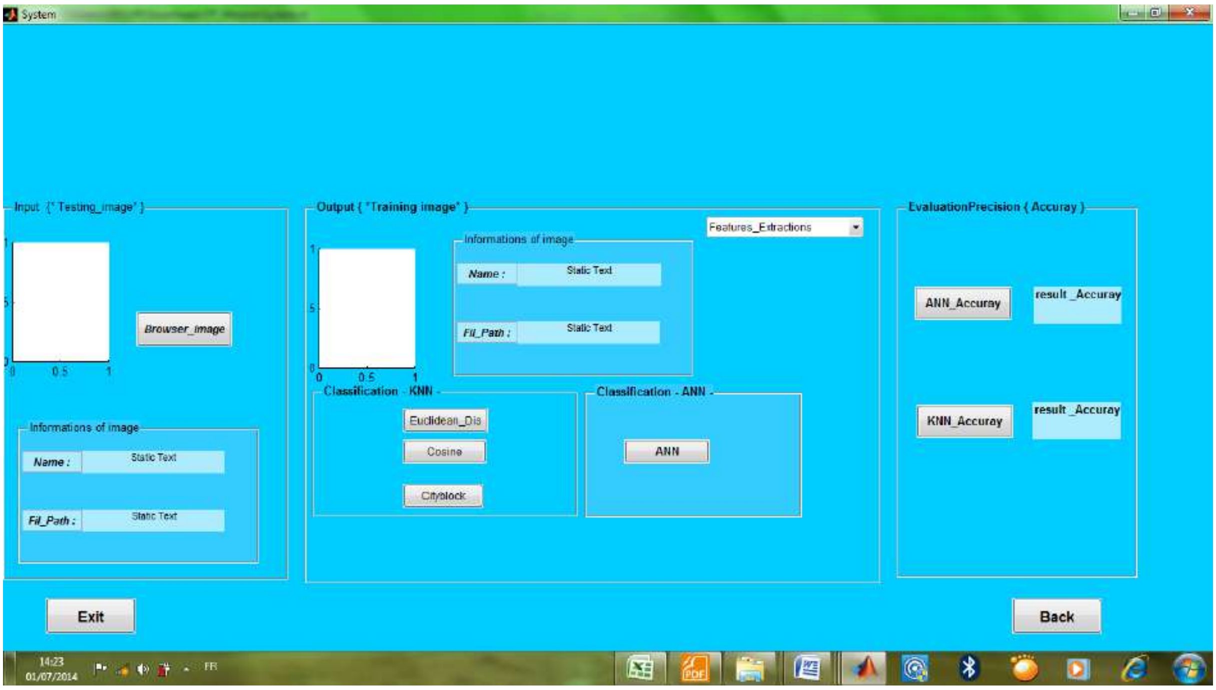

Figure III.6 : presented the interface system.

5. Conclusion :

In this chapter , we presented our application of ear recognition based on the algorithms GLCM , some different algorithms of LBP, we also presented the results obtained for every algorithm also by the classifiers methods and calculate the accuracy. Our system of ear recognition is applied on the ear database IIT Delhi. To conclude, we can note that the method MB_LBP with distance cityblock is the most effective for the features extraction. However, we also saw that many exterior factors influence the quality of the recognition.

The

General Conclusion

General Conclusion :

The biometrics is a domain at the same time fascinating and complex. It tries, by often much evolved mathematical tools, to make the distinction between individuals, obliging us to work in a context of very big diversity. This diversity also finds itself in the considerable number of algorithms which were proposed in ear recognition. In this report, we were interested in the problem of ear recognition.

Our work consists in the development of a strong algorithm intended to recognize an individual by its ear by using two methods among the methods the most used in this domain. The technical first one is LBP and the second is GLCM.

Experiments were conducted on IIT-Delhi-I dataset, where a promising recognition rate of 87.47% is achieved.

If the biometrics is a stake important for the economic level, the research, in particular in the field of the ear recognition offer another very open field of investigations.

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ABSTRACT :

Ear recognition has attracted a lot of attention during the last decade. In this work, we develop a system for ear recognition based on local texture descriptors. In particular, we propose to employ Gray-Level Co-Occurrence Matrix (GLCM) and Local Binary Patterns descriptors for describing ear images. We conduct experiments on the well-known IIT-Delhi-I dataset which is made up of 493 images from 125 persons. Experimental results yield promising result.

Key Word: Ear Recognition , texture descriptors dataset.

Résumé :

La reconnaissance des oreilles a beaucoup attiré l'attention au cours de la dernière décennie. Dans ce travail, nous développons un système de reconnaissance de l’oreille basé sur des descripteurs de texture locaux. En particulier, nous proposons d’utiliser des descripteurs de matrice de cooccurrence de niveau de gris (GLCM) et de modèles binaires locaux pour décrire les images des oreilles. Nous menons des expériences sur le célèbre ensemble de données IIT-Delhi-I, composé de 493 images de 125 personnes. Les résultats expérimentaux donnent des résultats prometteurs.

Les mots clé: reconnaissance des oreilles, descripteurs de texture, ensemble de données.

تلخيص :

جذب التعرف على الأذن الكثير من الاهتمام خلال العقد الماضي. في هذا العمل ، نقوم بتطوير نظام للتعرف على الأذن بناءً على واصفات الملمس المحلية. على وجه الخصوص ، نقترح استخدام مصفوفة التواجد المشترك باللون الرمادي (GLCM) واصفات الأنماط الثنائية المحلية لوصف صور الأذن. نجري تجارب على مجموعة بيانات IIT-Delhi-I المعروفة والتي تتكون من 493 صورة من 125 شخصًا. النتائج التجريبية تسفر عن نتيجة واعدة.

الكلمات المفتاحية: التعرف على الأذن, واصفات الملمس المحلية, مجموعة بيانات