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M.Sc. THESIS

USING GLCM BASED ON LBP/ DATA MINING TOOLS FOR HUMAN IDENTIFICATION THROUGH PALM VEIN IMAGE

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June, 2016

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APPROVAL PAGE

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ABSTRACT

Palm recognition is one of the research areas that has been considered in recent years. The palm vein pattern is not popular biometric because of its high development cost when compared with other biometric system such as fingerprint, palm print, face and iris. However, the main advantage of palm vein on classical biometric is the low risk of falsification, uniqueness, strong immunity to forge and stability. In biometric systems, there are many methods to allow identification or verification of human persons such as handprint, voice, finger print, face, palm vein image, which are used in many applications computer systems, laptops, secure access to buildings, and ATMs, cellular phones. In our work, we have tried to use palm vein image with three methods identification of human persons. First method that we have used LBP with GLCM, where extract features and combine all of them. Second method we used wavelet transformation (WD) algorithm with LBP, GLCM, where we used WD to compression the images and add more extract to our model. Third method that we have used is one of type data mining (neural network), the aim of our thesis is to get the high accuracy of palm vein recognition for human identification. The outcomes reveal that we get the high accuracy rate with large numbers of persons by suing the first method. We have used a ready palm print image database.

Key words: Gray Level Co-occurrence Matrix (GLCM), Local binary pattern (LBP), Wavelet Transformation ,Datamining Tools.

LBP/VERİ MADENCİLİĞİNE DAYALI GLCM KULLANARAK AVUÇ İÇİ DAMAR GÖRÜNTÜSÜ İLE KİŞİ TANIMA

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ÖZ

Son yıllarda, avuç içi tanıma diğer biyometrik tanıma yöntemlerine (yüz, iris, parmak izi ve avuç içi baskı) göre yüksek maliyeti olması nedeniyle popüler biyometrik olmadığı kabul edilir. Ancak, avuç içi tanımanın klasik biyometrik yöntemlere göre sahtecilik riskinin az olması, teklik ve tutarlı güçlü bağışıklık avantajları vardır. Biyometrik sistemlerde, kişilerin tanınması ve doğrulanması için el izi, ses, parmak izi, yüz, avuç içi damar görüntüsü gibi birçok metotlar vardır. Bu metotlar; bilgisayar sistemleri, dizüstü bilgisayarlar, binalara güvenli giriş ve ATM'lerde uygulamalarda kullanılır. Çalışmamızda, kişiyi avuç içi damar görüntüsü ile tanımak için üç yöntem kullanıldı. Birinci yöntemde, GLCM ile özellikler çıkartıldı, birleştirildi ve LBP ile tanındı. İkinci yöntemde, GLCM ile dalgacık dönüşümü (WD) algoritması kullanılarak resimler sıkıştırıldı ve LBP ile tanındı. Üçüncü yöntemde tanıma için veri madenciliği (sinir ağı, SOM) kullanıldı. Bizim tez çalışmasının amacı; avuç içi damar kullanarak yüksek oranda insan tanımaktır. En iyi sonucu 3. Yöntemde elde ettik. Hazır bir avuç içi görüntü veri tabanı kullanılmıştır.

Anahtar Kelimeler: Dalgacık Dönüşümü, yerel ikili desen (BA), Veri madenciliği araçları Gri Seviye Birlikte-Gerçekleşme Matrisi (GLCM)

To my beloved parents

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LIST OF SYMBOLS AND ABBREVIATIONS

SYMBOL/ABBREVIATION

GLCM	Gerry level Co-occurrence Matrix
LPB	local binary pattern
WD	wavelet transformation
ANN	neural network

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Information plays a significant role in the current era known as information revelation which we mean by the success of any organization, regardless of type state or a private enterprise depend highly on information system security and security of that information is essential for organizations that concern the protection of our property and private assets from falling into the hands of competitors or others that could misuse that information pirates of Networks and terrorist's cyberspace. Also, there is the need to sure from identification of persons Both from within and outside the Organization and whose work on this information Such information to ensure that no alterations or deletions through them, so have to be the mechanism to secure identification any person before allow him use this information, there are many ways to cure from a person identity. [1]

Firstly: when a person has a smart card, the card is approved. **Secondly**: when the person has an ID card or password. **Thirdly:** when the person has Definition of the characteristics of vitality such as fingerprint, palm vein and any physical characteristics of the person.

Therefore, the third alternative is considered as the most convenient as it provides us accuracy information about people when compared with the other methods through which Vital information can ensure personal identity without being forgotten or stolen such as it is with the use of ID cards or smart cards. For this reason, there is a current trend in the field of computers and information security replacing passwords and smart cards by vital measurements used to determine the identity of the person allowing him to physical or logical access to a building, or a computer, or a database [2].

Accordingly, for the past few years' research has been carried out on palm vein imaging in order to identify or verify individuals as there are many other biometrics such as eyes, fingerprints and facial features. However, palm vein imaging is thought to be much better than those mentioned, as it is constant, being inside the individual's body. That is to say, palm vein imaging is considered safer for keeping information, using unique models of palm vein verification, to identify people with a high degree of accuracy using information from inside a person's body, obtained through the near-infrared (NIR) light illuminators and cameras. So with vein technique it is almost impossible to forget or deceive vein models. The palm vein imaging model is widely used because the identification is more accurate. [1]. E-commerce applications have been rapidly growing which explains the necessity of honest user recognition for strong and secure access confirmation.

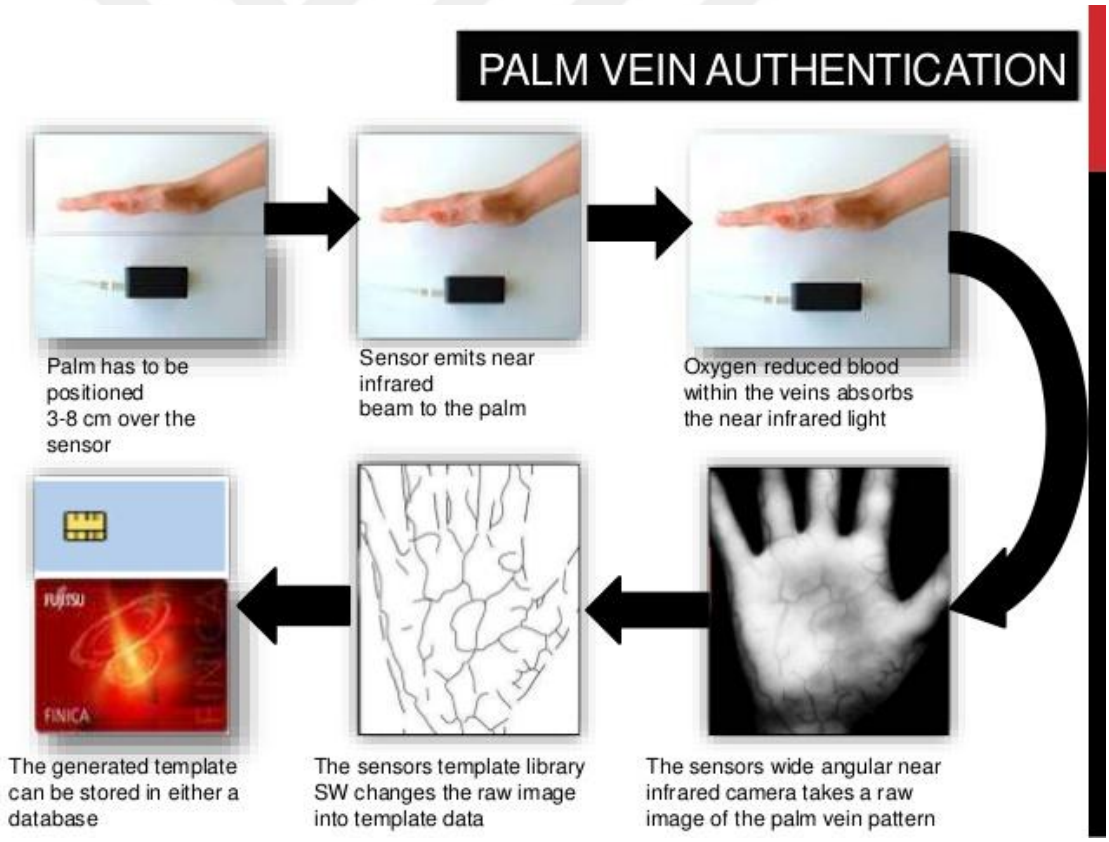

Figure 1.1 palm vein image [1]

1.2 STATEMENT OF THE PROBLEM

Fundamentally, we can recognize other people when we see or become familiar with their appearances or through their voices or sometimes from their hand writings. However, these methods have all now been considered to be old fashioned as these techniques were only used in the past to identify a person's or traveler's identity moving from one place to another. With the advanced current technology and improvement new methods have been discovered for the verification of identity such as Biometrics, so in the biometric there are identification and verification and the most significant distinction between them is with the way they are verified. There are two cases identify or rejection of the persons, any person has to prove his or her ID as the person they really are. For this reason, the persons have to prove their ID number and username before claiming identify. After that the person's biometric data is compared in order to know whether the data of the person is enrolled or not. By the help of biometric data through compared input data with data store, the system of biometric allows possible response, verified or not verified. In this thesis we will implement the gray level co- occurrence matrix and data mining tools for recognition of palm vein images.

1.3 PURPOSE OF THE STUDY

In this thesis we will use palm vein imaging database of polytechnic university for recognition. We will be using three methods the first method, will be Gray level co-occurrence matrix (GLCM) with local binary patterns (LBP), second method, the wavelet transformation (WD) with GLCM and LBP. After reading image and preprocessing, we will take the wavelet transformation for image compression. We will use image compression in order to reduce increase the images data because after compressing the images transporting and store images become easier. Then for the test of our work we will take the Gray level co-occurrence matrix for the whole of the images, where GLCM extract feature for all the images then put it in matrix each image has 12 forms, from first image until 8 image for training the system than from 9 image until 12 for test system, also each image has 63 feature in the matrix after that compute the minimum distance between the feature of input image with features matrix here will

use the Euclidean Distance to compute the distance. The third method LBP with one type of data Ming (neural network)Whenever the distance is smaller this means increasing the similarity of input with matrix Elements of (GLCM), here as there are a lot of features in the matrix here we can use the data mining tools to make the matrix as clustering each cluster has centroid, than it will just compare the input with this centroid instead of comparing it with all the cluster elements than through using With the application of Neural clustering methods we can make the feature matrix as clusters .

The Algorithm of Code

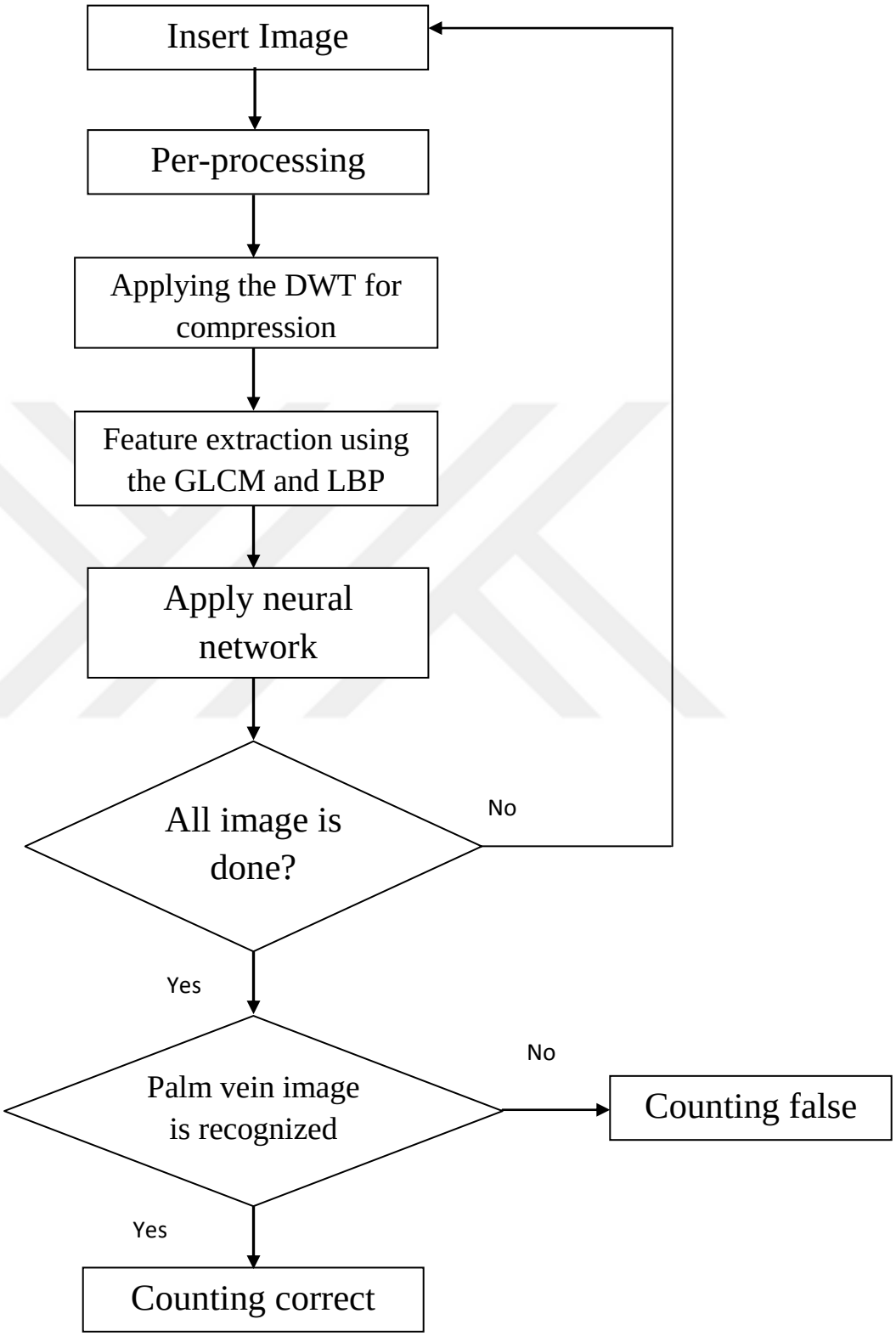

Figure 1.2 The algorithm of code

CHAPTER 2

LITERATURE REVIEW

2.1 **PALM VEIN**

Scientists have discovered that fingerprints are no longer accurate or guaranteed as it was previously thought, after the chaos of electronic piracy possible to copy fingerprints deceiving stronger safety systems in many mobile devices or security system in companies, institutions therefore have discovered new methods to get personal information through image palm vein, with the help of which hand print vein is considered unique. Since fingerprints are individual even for the twins, they do not resemble to each other at all., it can capture hand print vein through touching the hand on scanner Optical infrared which absorbs your hemoglobin, then the black veins appear in the image and the software is capable of recording data and imprint this your vein [2-3].

2.2 ADVANTAGES OF USING THE PALM

There are many advantages of using the palm, in palm vein imaging using vascular model on part of back of a hand to vein verification. However, it is difficult to use all the parts of a hand also it is more complex in palm vein model, another advantage of palm vein is, there is no hair in our palms this means we can take a picture of vascular patterns easily. also in the palm skin color variations are not important when compared with other biometrics such as finger, through which color leads to vision problems such as darkening in certain areas [3-4].

2.3 HOW CAN THE PALM VEIN BE DOCUMENTED?

The blood flows through the veins in palm which contains the Deoxygenated hemoglobin, when the palm is put in scanner the veins can teak the near-infrared rays, the scanner can vision the image after the light on hemoglobin, each capillaries and arteries dose not teak near-infrared light because the blood consists oxygenated hemoglobin, so the scanner dose not read it than will be invisible, in the end the image

still is captured which images it will be near infrared range, show as a black network, after that can store the images as dataset [4] .

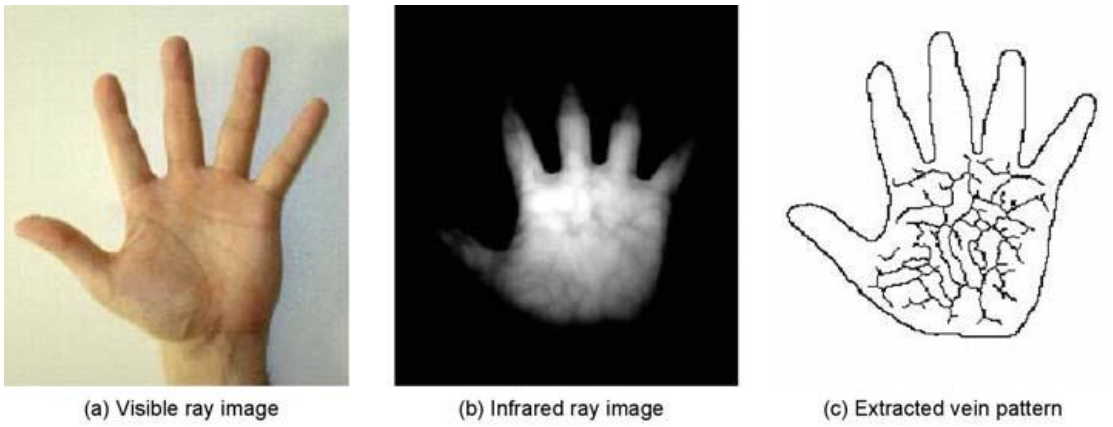

Figure 2.1. The image of palm vein after infrared ray than extraction vein pattern [4]

2.4 LITERATURE REVIEW

According to this study. using new technique for personal verification through using palm vein, where in the firstly enhanced of palm vein image then using the Gabber filter in order to extract the features, also using the Fisher Discriminate Analysis (LDA) in order to improve the palm vein decreases the dimension of the attribute s vector than we use the Gabor filter with all images pixels value as a characteristics vector in order to improve the features for verification, the sample will be less than the features , which solves the problem through making the features scatter matrix is a non-singularity. By the use of PCA (Principle Component Analysis) and SVD (Singular Value composition) also using the Nearest Neighbor classifier in order to (EER) where (EER) of the method is 0.2335%. [5].

Palm vein matching means checking two biometric characteristic vector in order to be sure about if there are the similarity or not. It been computing the identification between test set and the train set, where to computing the similarity used function Euclidean distance.

Experimental results, the Gabor filter is compared with four method David and Lee and propose Eigen value method, which implemented 8 directions and 8 scale by the Gabor filter, after reduce the dimensional decrease, then used the Fisher Vein method in order to get optimal verification characteristic to get to lowest EER value.

In the research the importance of using the palm vein to know person's identification is discussed because palm vein is considered to be the best when compared with other types of biometric such as face, iris, palm print and fingerprint through which palm vein can help us avoid some problems in identification and verification such as strong immunity, forge, uniqueness, falsification and stability. Palm vein based on back propagation neural networks, are used which is steps of the research. The area of interest (ROI) for palm vein were extracted the feature of the palm vein for using Sobel directional coding scheme for improved area of interest for each sample by the four directions was used the Otsu's theirs holding method in order to convert the image to gray-scale image, than before matching the feature to divide grayscale image 20x20 sub region than .(MAD) is Mean absolute deviation where it implemented to these sub-area as the characteristic vectors, in the end considered the feature sets as input for back-propagation neural network. According to final results for this research back-propagation neural network method it can get up to 98.75% of correct classification rates [6].

This research aims to finding the optimal palm print classification model, which uses SVM (support vector machine) to classifier the t palm print, then using GLCM to extract the feature and consider it as classification feature vector. In order to find the optimal model for thinner palm print classification, the accuracy of diverse classifier is compared with diverse kernel characteristics were used 400 experimental images to identification than for each level 100 , the positive thinner palm print is 200 , the negative thinner palm print is 200 , In each level for experiments there are 50 testing samples and 50 training samples in the SVM have two ways of classification ,SVM Binary Classification Algorithm and SVM Multi-classification Algorithm , where experimental results show that this planned in in this research show result of the precision (87.5%) is average of for binary classification of thenar palm print, but when using the SVM multi-classification, the result is not ideal. But if the numbers of samples are raised further or samples can be screened, this lead to improve the accuracy rate of classification [7].

This research focuses on palm vein recognition through Hybrid Principal to two algorithms Self Organizing Map (SOM) Component Analysis (PCA) and (PCA) used to analysis and identify the data patterns also to expressing the data in order to know similarity and dissimilarity of the data, Self-organizing feature maps (SOFM) Consider one of type important neural network, which used to reduce amount data which will use it to comparing, Have been used the input to neural network were unsealed (raw scale between 0 and 255) and scaled (scale between 0 and 0.9)Where using the recognition accuracy, different image resolutions, recognition time and different training data sets in order to estimate the execution the system, therefore, in the experiments the results show optimal recognition precision of between (55% and 98%) and (56%-99%) with algorithms PCA-ANN and scaled PCA-ANN according to at a resolution of between 30*30 and 60*60 pixels level of cropping. [8].

This research explains the importance using the palm vein in personal identification data with face feature in order to get a high precision of security identification. Through, using multi-modal verification method based on Palm Veins as a personal identifying factor by face feature according the results show that the instant Invariants technique offers the best recognition rate for all types of noise. and the face the recognition rate by more than 30%., where have used in This work recognizing person have four different statistical with palm vein and face images These approaches are Run-Length Matrix (RLM), Statistical Features (SF), Gray-level Co-occurrence Matrix (GLCM), and Moment Invariants (MIs). [9].

According to Ali Mohsin Al-juboori1, 2, Wei Bu3 Xiangqian Wu1,* and Qiushi Zhao1, they explain that why palm vein image important in security application , where it more due to plan vein exist inside the body not ease to forget or fake if we compared with other biometric like face , fingerprint and palm print where using the unparalleled models for palm vein verification in order to differentiate persons at a high level of precision , Where using model of palm vein images verification through apply the Gaussian matched filtering and after that two types of attribute extraction are extracted , using the wavelet coefficients for The global features and using local binary pattern (LBP) in order to local feature , also in this research , it have used Isometric Projection (a linear dimensionality reduction algorithm) In the end , using the Manhattan Distance (MHD) in order to matching technique in order to prove the

examination palm vein images , through which the experimental this work the result shows the EER to the proposed technique is 0.17488%.[1].

CHAPTER 3

METHODOLOGY

3.1 GERY LEVEL CO-OCCURRENCE MATRIX

There are many types of methods for texture analysis and the widely known is Grey Level Co-occurrence Matrix (GLCM). with which texture considered most important in identifying regions of image because texture is a significant attribute which is used in this field. Haralick [10] Back in 1973 suggested.(GLCM) Grey Level Co-occurrence Matrices as method for characteristic extraction. After that has used GLCM in a lot of applications in order to texture analysis, Moreover, GLCM site is one of the most important feature extraction technique of texture analysis. where Haralick extracted fourteen features from GLCM to characterize [11-12].

3.2 THEORETICAL BACKGROUND

The co-occurrence matrix and texture attributes for robotic ranking of rocks into six layers' insert by Haralick in 1973 [10]. These features are extensively used for different kinds of images. Now we need to discover the definitions and background in order to understand how can compute of GLCM.

3.3 CONSTRUCTION OF THE TRADITIONAL CO-OCCURRENCE MATRICES

We suppose there is gray scale image, then suppose N is total number of gray level of image. Haralick specify that (GLCM) Grey Level Co-occurrence Matrix is a square matrix G of request N, where G represent the number of place a pixel, where the (i, j) the entry on G and intensity i with a pixel intensity is neighboring. So through dividing all factor of G by the total number of co-occurrence pairs in G, we can get the normalized co-occurrence matrix, there are four directions (vertical, horizontal, left and

right diagonal) the adjacency can be known and can get all place of them as it is shown in figure 1. Where the texture features of The Haralick are computed for all each these directions of adjacency [13].

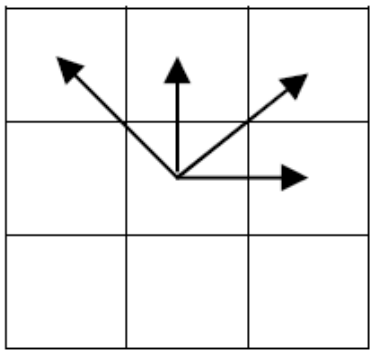

Figure 3.1 the four directions of adjacency for calculating the Haralick texture features [13]

We need to find average for all directional o-occurrence matrix, in order to calculate texture feature. Than using the Euclidean distance to work bigger these ideas to n-dimensional, defining precisely the grey scale images in n-dimensional distance and directions of adjacency in n-dimensional images on top mentioned.

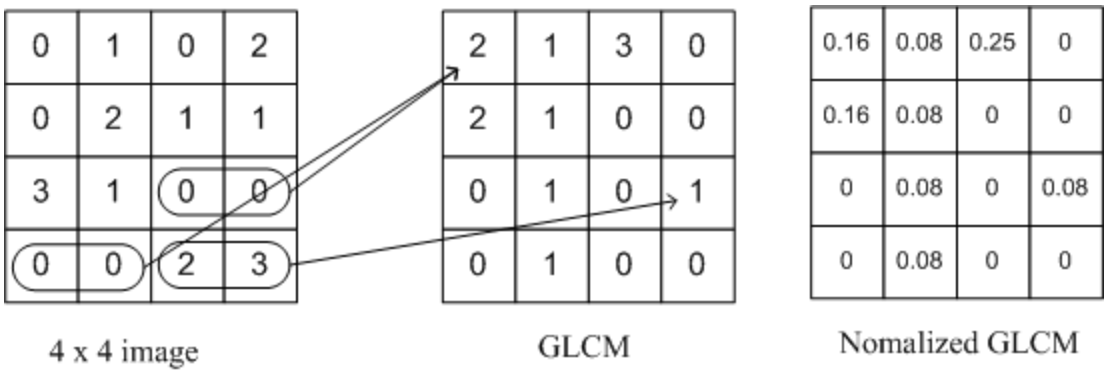

Figure 3.2 GLCM of a 4 _ 4 image for distance d = 1 and direction _=0 [13]

3.4 SIMPLIFICATION OF CRAY SCALE IMAGE

With the aim of creating larger concept of co-occurrence matrix to n-dimensional Euclidean space, mathematical pattern for the on top of concepts is required. It will treat our overall set as *n Z.* Here *n Z* =Z x Z x … x Z, the Cartesian product of Z taken n times with itself. Where, Z is the set of all integers. A point (or pixel in *n Z)* X in *n Z* is an n-tuple of the form X=(x1,x2, x2,…,xn) where *i x* ÎZ "*i* =1,2,3...*n* . An image I is a function from a subset of *n Z* to Z. That is *f: I* ®*Z* where *n I* Ì *Z.* If *X* Î*I* , then X is assigned an integer Y such that *Y = f* (*X*) . Y is called the intensity of the pixel X. The image is called a grey scale image in the n-dimensional space *n Z.* Volumetric data [14] can be treated as three dimensional images or images in 3 *Z.*

3.5 Generalized Co-occurrence Matrices

Generalized Co-occurrence Matrices Consider a grey scale image I defined in n Z. The gray level co-occurrence matrix is defined to be a square matrix Gd of size N where, N is the N be the total number of grey levels in the image. the (i, j) th entry of Gd represents the number of times a pixel X with intensity value i is separated from a pixel Y with intensity value j at a particular distance k in a particular direction d. where the distance k is a nonnegative integer and the direction d is specified by 1, 2, 3, (...,) *n d = d d d d,* where {0..} *i d* Î *k* −*k* "*i* =1, 2,3,..., *n.*

As an illustration consider the grey scale image in 3 *Z* with the four intensity values 0, 1, 2 and 3. The image is represented as a three dimensional matrix of size 3×3×3 in which the three slices are as follows.

$$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 2 & 3 \end{bmatrix}, \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 3 \\ 0 & 1 & 2 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & 3 & 0 \\ 0 & 3 & 1 \\ 3 & 2 & 1 \end{bmatrix}$$

The three dimensional co-occurrence matrix *d G* for this image in the direction *d* = (1, 0, 0) is the 4× 4 matrix

$$G_d = \begin{bmatrix} 1 & 3 & 2 & 1 \\ 0 & 0 & 3 & 1 \\ 0 & 1 & 0 & 3 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

Note that

$$G_{-d} = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 3 & 0 & 1 & 1 \\ 2 & 3 & 0 & 1 \\ 1 & 1 & 3 & 0 \end{bmatrix} = G_d' \quad ,$$

Theorem: If $X \in Z^n$, the number of independent directions from X in Z^n is $\frac{3^n - 1}{2}$.

It can be seen that $X + d = Y$, so that' $d\ d\ G\ G - =$, where ' $d\ G$ is the transpose of $d\ G$. Hence $d\ d\ G\ G - +$ is a symmetric matrix. Since'd $d\ G\ G - =$, we say that $d\ G$ and $d\ G -$ are dependent (or not independent). Therefore, the directions d and –d is called dependent or not independent

Theorem if $X \in Z^n$, the number of independent directions from X in Z is $\frac{3^n - 1}{2}$

Proof: Suppose $n\ X$ ÎZ. If $n\ Y$ ÎZ is such that X+d=Y, where 1, 2, 3, (...,) $n\ d = d\ d\ d\ d$. We know that {0, , } $i\ d$ Î $k - k$, if the distance between X and Y is k. So we need to count the number of possibilities for forming the direction d. There are n positions 1, 2, 3,..., $n\ d\ d\ d\ d$ each of which can be filled using any of the three numbers 0, k or –k. This can be done in 3n ways by multiplication principle. When all the positions are filled using 0, we have d = (0,0,0,...,0) so that X+d=Y implies X=Y. Therefore, there are 3 1 n − directions from X in which exactly half of the directions are independent. Therefore, there are independent directions from X in $n\ Z$.

If two directions are independent, the corresponding co-occurrence matrices are transposes of each other. The above theorem indicates that the number of possible co-occurrence matrices for an n-dimensional image is $\frac{3^n - 1}{2}$

3.6 TEXTURE FEATURES FROM GLCM

Through applying this equation, it can compute the different texture feature which can be used for training the classifier.

3.6.1 CONTRAST

We can call the equation (sum of squares variance) because this equation measures the intensity contrast between a pixel and its neighbor for whole image, calculate the total of collection in gray level image. So the equation (1) is

$$\textbf{CONTRAST} = \sum_{n=0}^{Ng-1} n^2 \left\{ \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} Pd, \theta(i, j) \right\}, \text{ Where } n = \left| i - j \right| \quad (1)$$

Where *i* and *j* are the coordinates in horizontal and vertical matrix and *P* (*i, j*) is matrix value in *i* and *j* coordinate [15].

3.6.2 ENERGY

It is called the “uniformity”, is a calculation of the gray level concentration of intensity in GLCM. It returns the total of squared elements in GLCM. Energy value computed using equation 2[15].

$$\textbf{ENERGY} = \sum_{i,j=1}^{M} Pi, j^2 \quad (2)$$

Where *i* and *j* are the coordinates in horizontal and vertical matrix and *P*(*i, j*) is matrix value in *i* and *j* coordinate.

3.6.3 VARIANCE FEATURE

Here we have Variance equation, which uses the equation in order to calculate of the dispersion for the values around the average of combinations of neighbor pixels and reference, also we can see it is alike to entropy, for answer the function. Now there is a question what is dispersion of the variation between the neighbor pixels and reference in this window? [15].

$$\textbf{VARIANCE} = \sum_{i=0}^{Ng-1}\sum_{j=0}^{Ng-1}(i-\mu)^2 Pd,\theta(i,j) \qquad (3)$$

3.6.4 CORRELATION FEATURE

Through Correlation feature we can show that linear will be depended on gray value in the co-occurrence matrix where we can figure out how a reference pixel is correlated to its neighbor, where (0) refer to uncorrelated while that (1) refer to perfectly correlated.

$$\textbf{CORRELATION} = \sum_{i=0}^{G-1}\sum_{i=0}^{G-1}\frac{\{i\times j\}\times P(i,j)-\{\mu_x\times\mu_y\}}{\sigma_x\times\sigma_y} \qquad (4)$$

Where _x; _y and _x; _y are the means and standard deviations of px and py.

3.6.5 INVERSE DIFFERENCE MOMENT (IDM) FEATURE

It can be called inverse difference moment (IDM) feature by homogeneity, where it computes the local homogeneity for an image. Inverse difference moment (IDM) feature can gets the calculation of the closeness of the distribution of the GLCM.

$$\textbf{INVERSE} = f6 = \sum_{i=0}^{Ng-1}\sum_{j=0}^{Ng-1}\frac{1}{1+(i-j)^2} Pd,\theta(i,j) \qquad (5)$$

Where that (IDM) weight is the opposite with Contrast weight, with weights decreasing exponentially away from the diagonal**.**

3.6.6 SUM AVERAGE FEATURE

$$\textbf{SUM AVERAGE} = \sum_{i=0}^{2(Ng-1)} i.p_x + y(i) \tag{6}$$

3.6.7 SUM VARIANCE FEATURE

$$\textbf{SUM VARIANCE} = \sum_{i=0}^{2(Ng-1)} (i-f_7)^2\, p_x + y(i) \tag{7}$$

3.6.8 SUM ENTROPY FEATURE

$$\textbf{SUM ENTROPY} = \sum_{i=0}^{2(Ng-1)} p_{x+y}(i) \log p_{x+y}(i) \tag{8}$$

3.6.9 DIFFERENCE VARIANCE FEATURE

$$\textbf{DIFFERENCE} = \sum_{i=0}^{Ng-1} (i - f_{10})^2\, p_{x-y}(i) \tag{9}$$

3.7 WAVELET TRANSFORM

For the past few years we have been experiencing increasing growth in different fields of technology especially in image processor, because we have to handle with a lot of data, this leads to increasing necessity to provide huge memory, also when we want to save the data in memory after that retrieved by a good technique, in order to put it in practical use, with which Wavelet can provide us mathematical method in order to encoding information to layers through the level of detail. Because of this layers will ease estimates at different middle stages. for this reason, we can store these

approximations in less space of memory than original data, in order to compression a low complex image using wavelet method as the basic function and measure the quality compression image. [21,22].

3.2.1 WAVELET METHOD TO COMPRESSION 2D IMAGE

Using the WT for each image, in the first step apply 1-D filter bank to rows of the image. Second step apply same transform to the columns of each channel. Corresponding to vertical, we can get three high pass channel. Diagonal and horizontal, and one estimate image, so the Discrete Wavelet Transform for any image as a 2D signal get from 1D DWT, through multiplying two 1D functions, we can get the scaling function and wavelet function for 2D, because of multiplying two 1D scaling functions through got thought for the scaling function.

$$\varphi(x,y)=\varphi(x)\varphi(y) \qquad (1)$$

It can get the wavelet function through multiplying two wavelet functions or wavelet and scaling function for 1D, there are three wavelet function which scan details in horizontal of the 2D case.

Horizontal: $\Psi^{(1)}(x, y) = \varphi(x)\Psi(y)$ (2)

Vertical: $\Psi^{(2)}(x, y) = \Psi(x)\varphi(y)$ (3)

Diagonal directions: $\Psi^{(3)}(x, y) = \Psi(x)\,\Psi(y)$ (4)

This represent as a (4) channel rebuilding filter bank we can see in Figer.4. Subscript representative with 2D is each filter the kind of filter (HPF or LPF) for vertical and horizontal components an image is decomposed into four bands through these filets in one phase.

We can see for each resolution their type of detail images horizontal (HL) vertical (LH), and diagonal (HH), with the low (LL) the operation can be repeated band using the next

phase of the same filter bank, feature 2D DWT used in images compression, we see generates the hierarchical structure in Fig. 3.3[21,22].

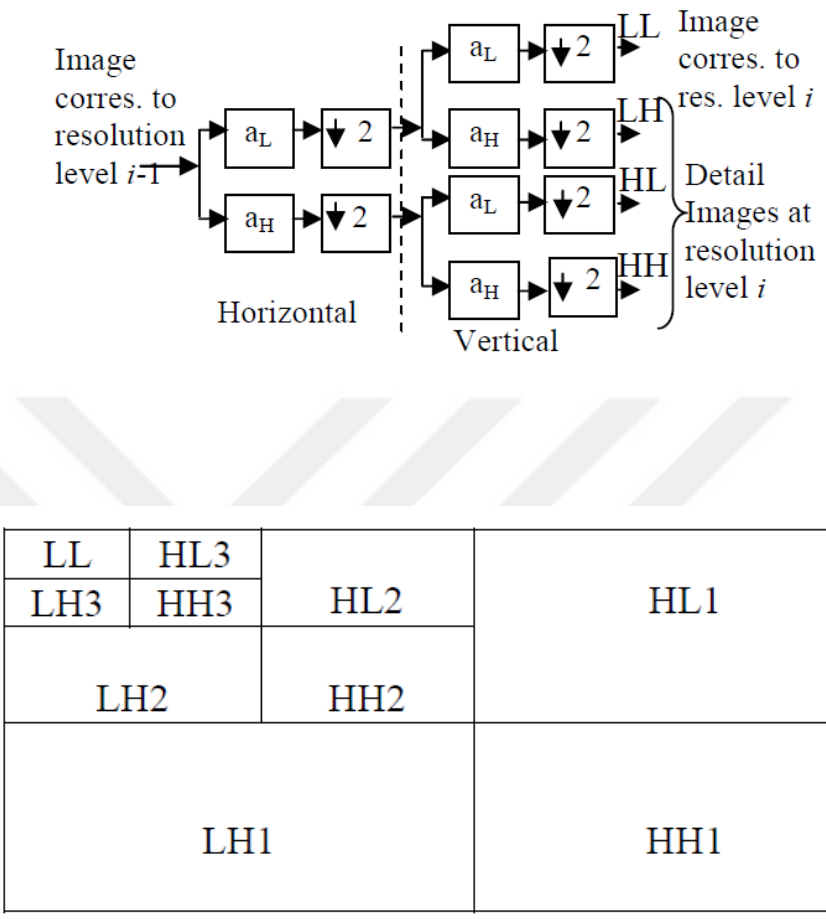

Figure 3.2. Structure of wavelet decomposition [22]

3.8 LOCAL BINARY PATTERNS

Local binary pattern (LBP) is considered as one of the types for feature used in classification and analysis of feature of grey scale images. The LBP operator is a simple theory and it is very powerful technique of analysis texture [24]. Presentation stellar results from precision and computational complexity in a lot of experimental studies. The local binary pattern can be considered as a technique to traditionally ramify statistical and structural patterns of texture analysis, it can describe the texture through micro-primitive as (Textons) and their statistical position rules. Electively, the primitive

has able to like with a consummated measure of local image dissimilarity, which calculate the power of the primitives. [25].

3.8.1 BASIC LOCAL BINARY PATTERNS

The pixels of an image with decimal numbers label of the original LBP operator that can be called as LBP codes or Binary patterns, where around each pixel encode by the local structure, as show in fig, 7. Where it will have compared each pixel with eight neighbors in a 3x3 neighborhood through subtracting of the center pixel value. The negative values are encoded with 0 as The resulting strict but others with 1, We can get the binary number through concatenating all these binary codes in a clockwise direction, where begging from the top-left one and its corresponding decimal value is used for labeling. We can understand that the binary numbers derived from Local Binary Patterns or LBP codes [25-27].

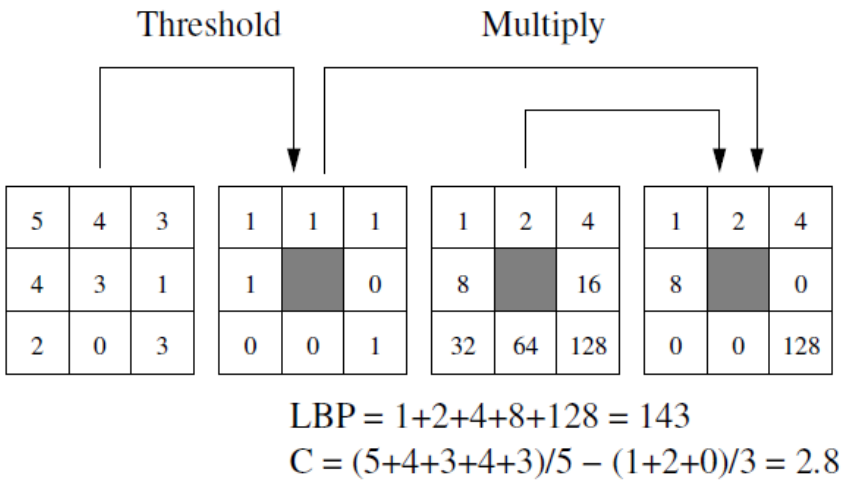

Figure 3.3 calculating the original LBP code and a contrast measure [25]

Now through the existing shape of the LPB operator which is explained in Figure 3.3 is more diverse from this essential version , For the unique description is extensive to random circular vicinities, and it have been developed a number of extensions, where there is same basic idea , whereas a binary system which explains the local texture model executed staring with vicinity by the fray value of the center , Moreover , this operator is linked with many texture analysis technique , as shown in the figure 3.4 .

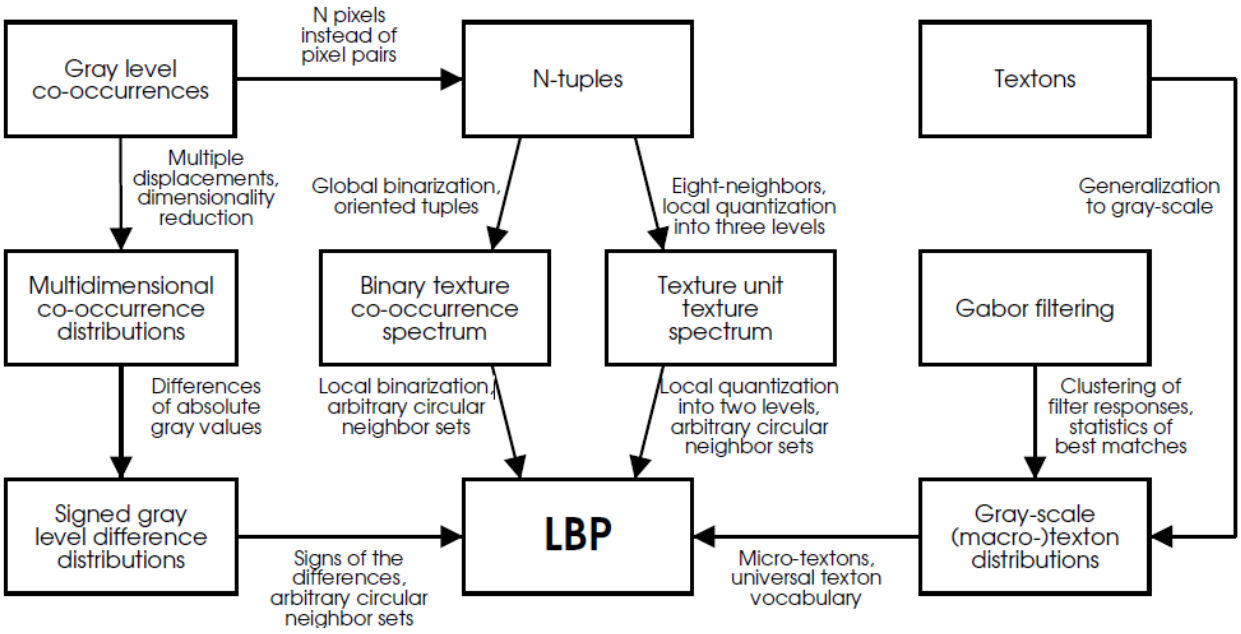

Figure 3.4 LBP in the field of texture analysis operators [25]

3.8.2 EXTENDED UNIFORM LBP OPERATOR

The basic LBP operator cannot take main feature with large scale structures with small 3x3 vicinity. Because there is the texture at diverse scales, where it is scheduled to use the operator neighborhoods of different sizes [27]. It can identify a local vicinity as a set of sampling points equally spaced on a circle which it is centered at the pixel to be labeled, where the pixels are inserted using bilinear interpolation, if the sampling points that do not fall within the pixels, so letting for any number of sampling points and any radius in the vicinity. As a show in Fig 9 where there are some examples of extended LBP where we can see it, where the notation *(P, R)* denotes a vicinity of *P* sampling points on a circle of radius of *R*.

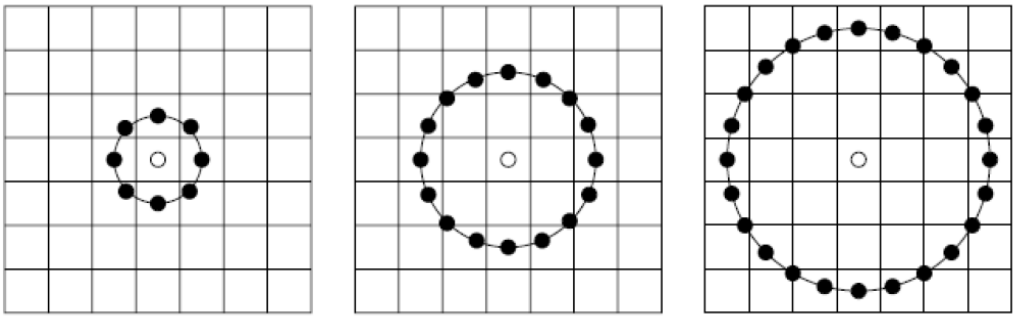

Figure 3.5 Examples of the extended LBP operator [20]: the circular *(8, 1), (16, 2)*, and *(24, 3)* neighborhoods [27].

Formally, given a pixel at (*xc*, *yc*), the resulting LBP can be expressed in decimal form as:

$$LBP_{P,R}(x_c, y_c) = \sum_{p=0}^{p-1} s(i_p - i_c)2^p \qquad (1)$$

Where (ic,iP) it will be respectively gray-level values of the central pixel and P the circle neighborhood with a radius R the P surrounding pixels will be in the circle , and function *s(x)* is defined as:

$$s(x) = \frac{1}{2}\begin{cases} \text{if } x => 0 \\ \text{if } x < 0 \end{cases} \qquad (2)$$

As mentioned above, order in the local neighborhoods, the basic LBP operator is constant to monotonic gray-scale transformations keeping pixel intensity. Through a region can be exploited as a texture descriptor, it has been computed the histogram of LBP labels.

The operator *LBP (P, R)* produces *2p* different output values, corresponding to *2p* different binary patterns formed by *P* pixels in the neighborhood. If the image is rotated, these surrounding pixels in each neighborhood will move correspondingly.

Along the perimeter of the circle, resulting in a different LBP value, except patterns with only 1s and 0s. In order to remove rotation effect, a rotation-invariant LBP is proposed in

$$LBP_{P,R}^{ri} = \min\{ROR(LBP_{P,R}, i) \mid i = 0,1.....P-1\} \quad (3)$$

Where *ROR (x, i)* performs a circular bit-wise right shift on the *P*-bit number *x i* times. The *LBPri (P, R)* operator quantifies occurrence statistics of individual rotation invariant patterns corresponding to certain micro-features in the image; hence, the patterns can be considered as a feature detector However, in [40], it was shown that such a rotation-invariant LBP operator does not necessarily provide discriminative information, since the occurrence frequencies of the individual patterns incorporated in *LBPri (P, R)* vary greatly and the crude quantization of the angular spaces at 45° intervals. [27-28].

3.9 DATA MING

actually, after the increasing of developing in all fields in our lives, that followed information revelation which contain a huge amount data a variable, in order to it to use this data we have to convert it to useful information in order to particle use. where it is more important to analysis this huge amount of data to extract helpful information from this data. Moreover, we need to perform this data not only process it, where data mining also includes many process such as, Data Presentation, Pattern Evaluation, Data Transformation, Data Integration, Data Mining and Data Cleaning [29].

3.9.1 WHAT IS THE DATA MING

Actually, we can define data mining to many definition, Analysis and exploration through means by automatic or semi-automatic of huge data to discover significant models Figure 3.6 [30-31].

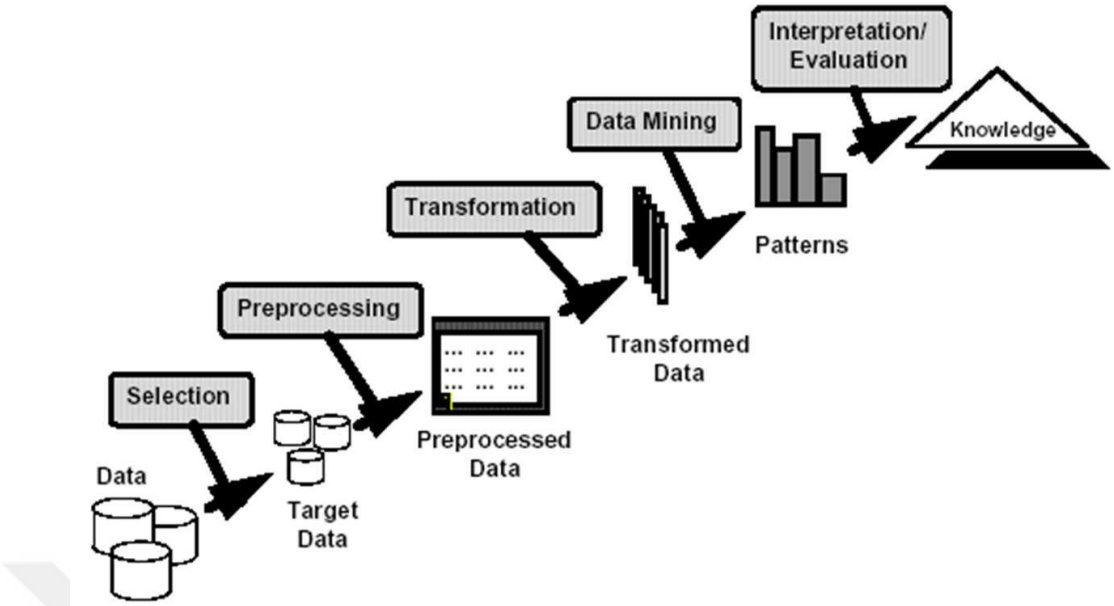

Figure 3.6. Structure of data mining [30]

3.9.2 ORIGINS OF DATA MINING

It can be through Draws thoughts from machine learning/AI, model recognition, database systems and statistics.

There are many reasons why the Traditional Techniques are unsuitable.

– Heterogeneous, distributed nature of data

– High dimensionality of data

– Enormity of data

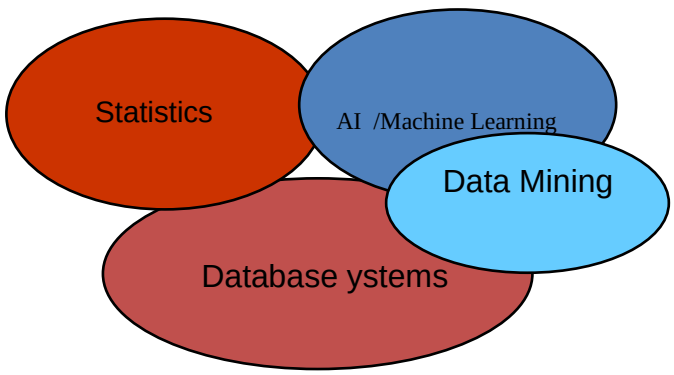

Figure 3.7 Stricture of data mining [44]

3.9.3 DATA MINING TASK

In data mining there are two types of main tasks (Prediction Methods and Descriptive Methods), we can classify these tasks as follows:

- Classification [Predictive]
- Clustering [Descriptive]
- Association Rule Discovery [Descriptive]
- Sequential Pattern Discovery [Descriptive]
- Regression [Predictive]
- Deviation Detection [Predictive]

In our research we will focus on clustering analysis and explaining what Cluster Analysis is and how can clustering be useful also we will mention about the types of clustering and clustering approaches.

Cluster this manse we have many groups of similar of objects. On the other hand, Finding this groups automatically. these groups contain similar or related (these objects share common attribute) to one other in same group but it will be different with objects in others groups. [29-30].

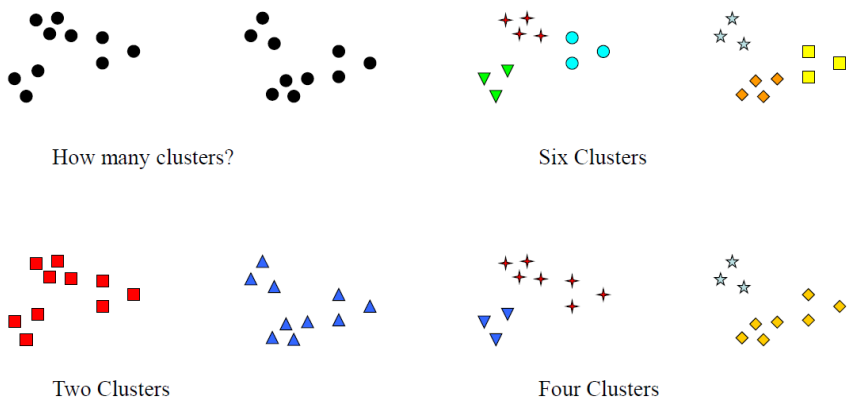

Figure 3.8. Types of clusters [44]

where there are (Intra, inter) in each cluster, intra is the distance between the elements of same cluster, inter is the distance between the cluster with other cluster, therefore, the optimal cluster which has Inter-cluster distances are maximized and Intra-cluster distances are minimized as shown in the figure 3.9 [31].

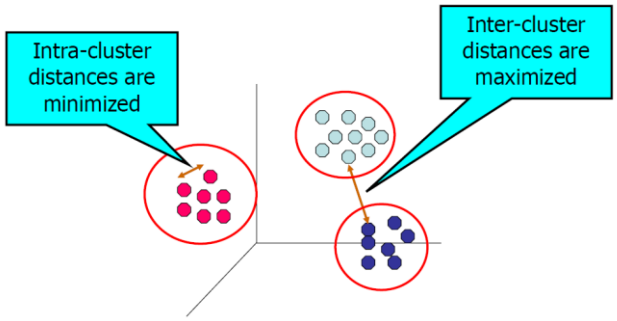

Figure 3.9. Type of cluster [31]

3.9.4 TYPE OF THE CLUSTER

3.9.4.1 Well-Separated Clusters:

When the cluster is set of points which is in the same cluster and is nearer (similar) to all other point in this cluster, then it to any point in other cluster. Figure 3.10.

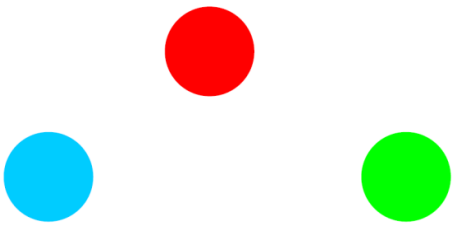

Figure 3.10. Well-Separated Clusters [44]

3.9.4.2 Center-based

When the cluster is considered as a set or group of points which will be in same the cluster, also it is closer (similar) than to the center of any other cluster, the centroid is always the center of a cluster, it is average of all the points in this cluster, or a medoid, the most “representative” point of a cluster. Figure 3.11.

Figure 3.11. Center-based [44]

3.9.4.3 Density-based

In this type of cluster all the points are dense, where the cluster is separated by low-density areas from other areas of high density. Using the cluster when it to be irregular, also when to be noise and outliers are present.

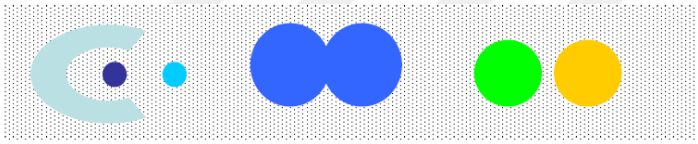

Figure 3.12. Density-based [44]

3.9.5 CLUSTERING APPROACHES

Clustering approaches are divided into (*Classical clustering methods and Neural clustering methods*) , the our aim is Self-Organizing Map (SOM) where we will use (SOM) to improve the results for (GLCM , LBP) whereas using the (SOM) to clustering the dataset to many cluster and find the centroid for each cluster , after that we will deal with dataset based on the clusters , also we will deal with each centroid based on one cluster , this lead to reduce the amount data which will process it , thus reduce the process time and error [31].

3.9.5.1 Classical clustering methods

–Partitional methods

–Hierarchical methods

–Density-based methods

3.9.5.2 Neural clustering methods

–Self-Organizing Map (SOM)

–Neural Gas (NG)

–Growing Neural Gas (GNG)

3.9.6 Artificial Neural Networks

Artificial Neural Networks are the techniques of calculation designed to simulate the way in which the human brain functions a specific task, through the huge processing, distributed in parallel, and is made up of units of simple treatment. These units are only elements of the calculation, which have the neurological properties, in that it stores (Nodes, Neurons) neurons or knowledge held called the experimental process and information to make it available to the user and that by adjusting the weights. Similar

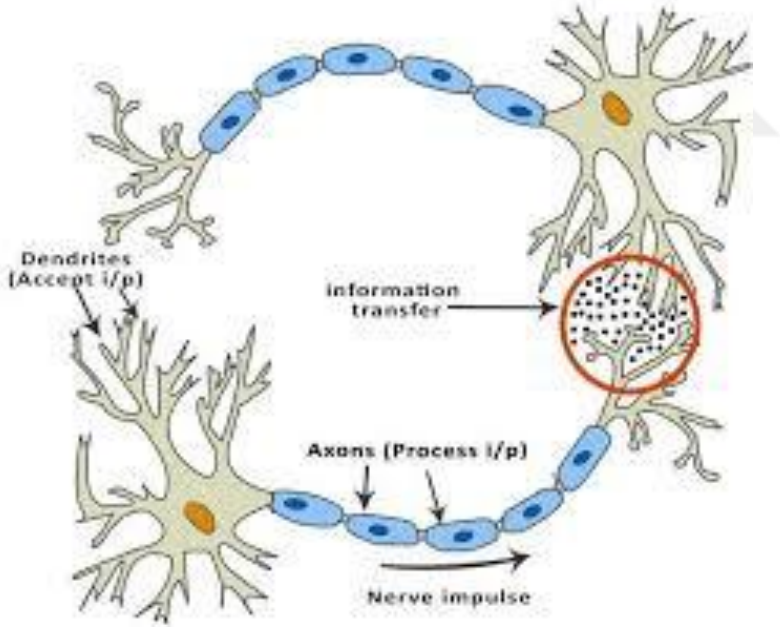

Figure 3.13 the neural network [31]

Similarity with the human brain in that they are gaining knowledge training and store this knowledge using the powers if the ANN We come to the conclusion within neurons

called weights interrelation. There is also a spooky resemblance to a dynamic which gives the opportunity for scientists Biology relying on to figure out the evolution of the vital phenomena. ANN [31].

3.9.7 ARTIFICIAL NEURAL NETWORK COMPONENTS

As we have seen that, the neural networks consist of a set of processing units called one neuron, and figure (1) it reveals that the model is not in writing and a simple artificial neuron. In addition, for person units to enter the outside world, which enriches the five senses, so too neural networks need Units of entry. The processing units are the calculations adjust the weights and get through it on Rose Appropriate action for each entrance of the inputs of the network. Units are to be input layer called input layer, and units Treatment is treatment layer, which comes out the network outputs. and between each layer of these layers there is a layer of Interfaces that connect each layer class that followed and in which they are adjusting the weights of each interface, the network has only one layer of input units, but may contain more than one layer of layers Treatment.

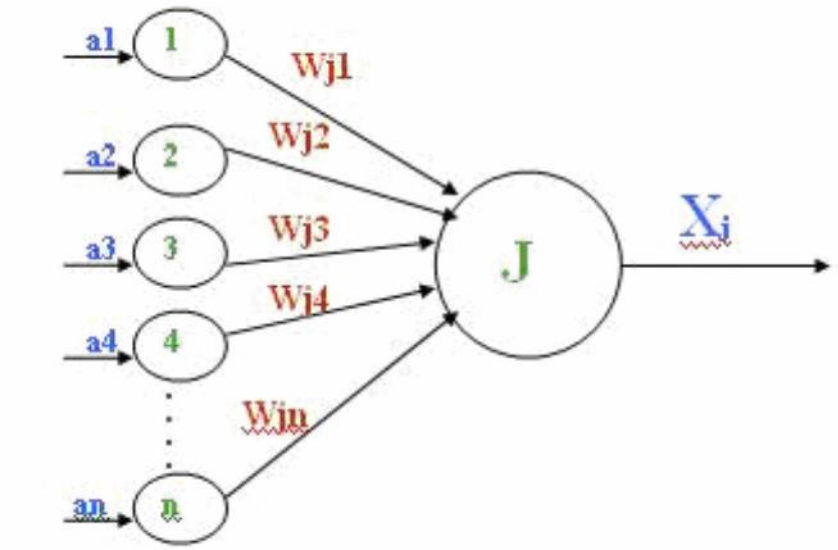

Figure 3.14 the neural [31]

The neural contain:

- (a1, a2…...an) is input
- (Wj1….Wjn) is weights where it crosses weight from the intensity of interdependence between the element before and after the element.
- J is Processing element, which consists of
    1. (Adder) Collect signals in the weighted income
    2. (Activation Function) transport and activation

This it limited output of neural in order to make the output between (0-1)

- Xj is Output

3.9.8 Architectural structure of neuronal networks

Architectural artificial neural network is the way that is connected by neurons with each other to form a network. This is related to the training algorithm, the network which consist Front single layer, the input (P) connect with neural through weights (W) as show in figure 3.15

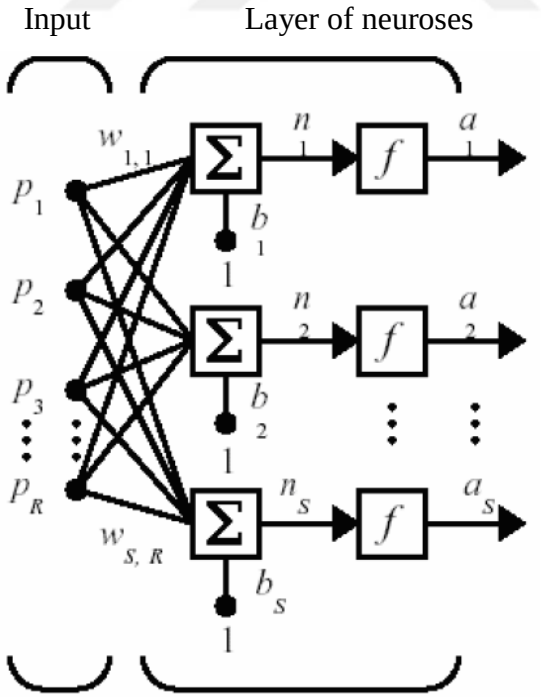

Figure 3.15 Architectural structure of neuronal networks [31]

Where $a = f(Wp + b)$

- **ns** numbers of neuroses in layers
- **p** input
- **R** number of element in input vector

Each neuron contains a link collector collects weighted with the shift income to form a numerical output of the neuron, the output layer of neuron from output vector (matrix one column) a results will give this output is:

$$\mathbf{W} = \begin{bmatrix} w_{1,1} & w_{1,2} & \cdots & w_{1,R} \\ w_{2,1} & w_{2,2} & \cdots & w_{2,R} \\ \\ w_{S,1} & w_{S,2} & \cdots & w_{S,R} \end{bmatrix}$$

Here the rows refer to aim neuron, the columns refer to input, also W1, 2 refer to weights to first neuron

3.9.9 Multi-layered front networks:

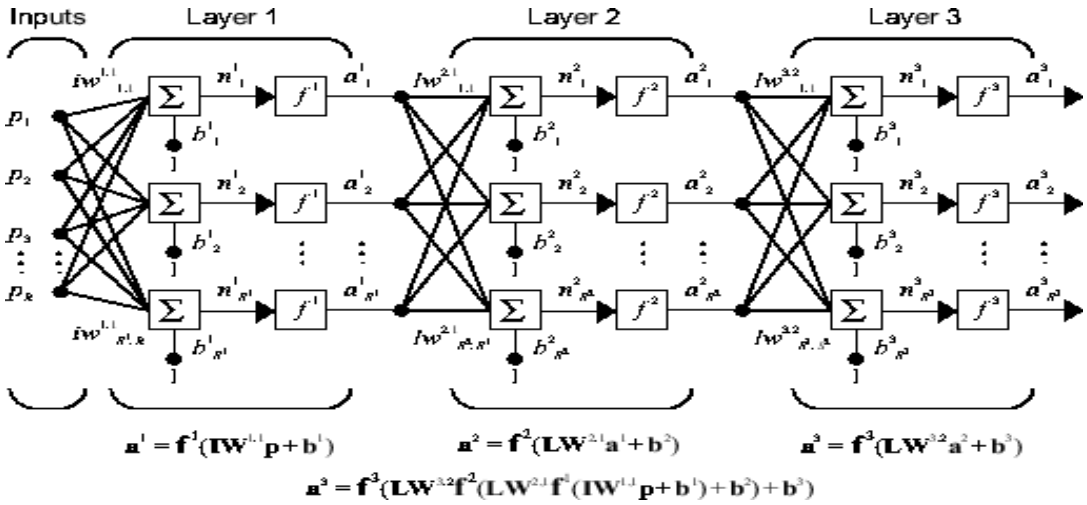

Figure 3.16 Multi-layered front networks [32]

Neural network can consist of several layers in which case each layer is the weight matrix the neural network can be from many layers in the case have to be weights for each layer W Offsets b and output a. in order to distinction between the layers put the number for each layer also for each used convert through the network of input, such as first neuron, second neuron, third neuron, also input for any layer considered input for next layer. For this reason, this network like network one layer [32].

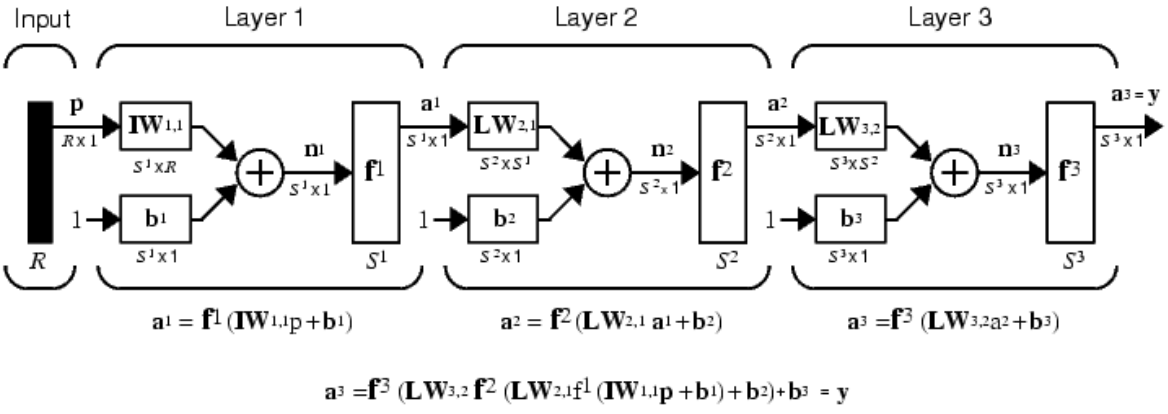

Figure 3.17 Multi-layered front networks

3.10 CHI-SQUARE DISTANCE

Chi-square distance is considered as one of the most important tools measures of distance, which we can use to compute dissimilarity between tow histograms, also it has extensively used in different applications like, object classification, texture, image retrieval, and, shape classification in histograms for a lot processes. where the difference between tow type of groups bins first large bins id less significant from small bins than should be reduced, where we can see that the chi-square histogram distance comes from the chi-square statistics in order to check the fit between observed frequencies and distribution through to find human vision perception for texture discrimination is based on second-order statistic.

$$x^2 = \sum_i \frac{(Q_i - E_i)^2}{E_i}$$

Where The chi squared distance d(x,y) is, as you already know, a distance between two histograms x=[x_1,..,x_n] and y=[y_1,...,y_n] having n bins both. Moreover, both histograms are normalized, i.e. their entries sum up to one. The distance measured is usually defined (although alternative definitions exist) as d(x,y) = sum((xi-yi)^2 / (xi+yi)) / 2 . It is often used in computer vision to compute distances between some bag-of-visual-word representations of images. The name of the distance is derived from Pearson's chi squared test statistic X^2(x,y) = sum((xi-yi)^2 / xi) for comparing discrete probability distributions (i.e histograms). However, unlike the test statistic, d(x,y) is symmetric wrt. x and y, which is often useful in practice, e.g., when you want to construct a kernel out of the histogram distances.

In category *i* there is *Qi* the observed number of case and *Ei* is the expected number of cases in category *i*. through computing the varies between numbers of case and in each category expected number of case we can get the chi square. The expected number of cases in that category by this difference is squared and divided, where added this values for all categories and the total is referred to as the chi-squared value.

In our system after selecting the images training and select the test images, then using the local primary patterns (LBP) and Cray Level Co-occurrence to extract the features and put it in the features matrix, and extract the test images, after that using chi-square in order to compute the distance between the test images with features matrix in order to determine which images are most similarity, through compute the distance for all features images and select shorter distance.

CHAPTER 4 RESULTS

Chapter four contains experimental results and presentation of them. The results are classified into three methods. First method is (local binary patterns (LBP) with (GLCM), second method (LBP) local binary patterns with (ANN) neural network, third method wavelet transform (WD) with (GLCM), (LBP).

4.1 THE RESULTS OF GLCM & LBP

As the Technique we have used two algorithms carry level co-occurrence (GLCM) and local binary patterns (LBP), where we used 4 function for GLCM (Contrast, Correlation, Energy, Homogeneity), so the numbers of features of (GLCM) are 4 features as show in the (Table.3) why we used this function from (GLCM) because through this functions we can improve the performance the local binary patterns (LBP). by using this functions, it can improve the images before use (LBP) to extract features this lead to increase accuracy images. also through merge features of (GLCM) with (LBP), where (GLCM) has four features and (LBP) has 59 features as a show in (Table.2). so we have a lot of features (63 features) this lead to increase accuracy of images. Form through this features we can increase. Through this features we can increase numbers persons and increase training images and test images for each person without big effect on accuracy and the time, if we compare with other ways. We can see that in the results in table (1), where we can use even 1-500 with a good result.

This table explain total training sample and identification accuracy for each person through GLCM and LBP methods, also we can the average total accuracy for persons.

Table 4.1. and identification accuracy (GLCM, LBP)

Person	Training sample										Average
	1	2	3	4	5	6	7	8	9	10	
20	100	95	100	90	100	70	85	85	95	85	90.5
40	100	97.5	97.5	97.5	65	85	92.5	90	90	90	90.5
60	100	96.6	95	88.3	61.6	86.6	90	91.6	91.6	93.3	89.46
80	100	96.25	93.75	90	93.75	58.75	81.25	86.25	92.50	93.73	88.62
100	100	93	90	92	92	90	61	81	87	95	88.1
140	100	91.42	87.85	89.28	92.14	51.42	76.42	83.57	92.85	95	85.99
180	100	89.44	88.88	90	91.11	51.66	74.44	81.66	92.22	93.33	85.27
300	100	85.33	87	89.66	89.66	45	67.66	78.66	87	81.1	81.10
											87.4425

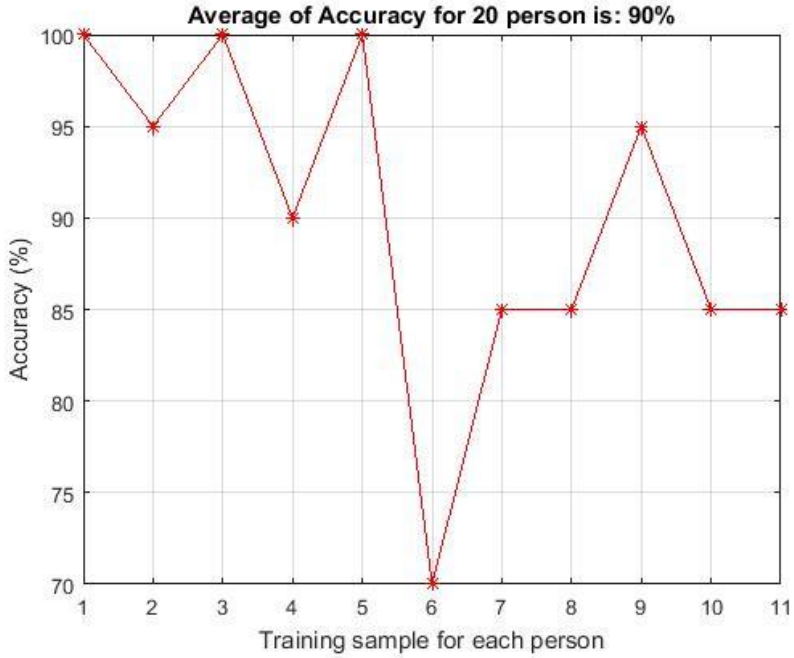

Figure 4.1. Accuracy of proposed method for 20 person

The accuracy of proposed method is shown in figure 4.1 As seen in this figure the 20 person is used for recognition. For each person about 1, 2, and 11 image is used for training. Also in .this figure there are high accuracy for 1, 3, 5, 6 training sample.

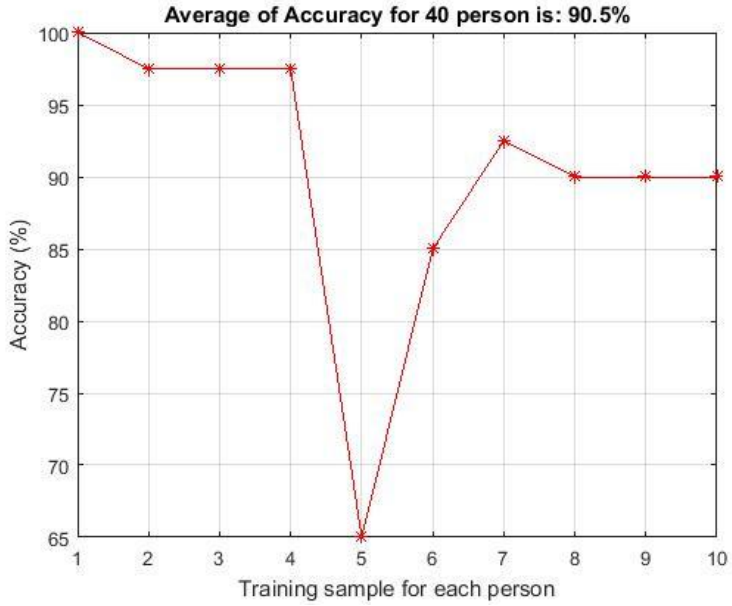

Figure 4.2. Accuracy of proposed method for 40 person

The accuracy of proposed method is shown in figure 4.2 As seen in this figure the 40 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2, 3, and 5 training sample.

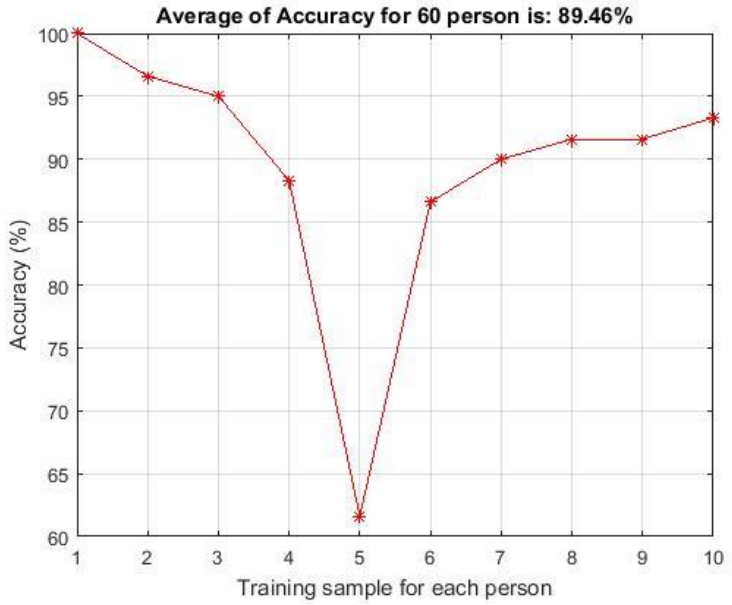

Figure 4.3. Accuracy of proposed method for 60 person

The accuracy of proposed method is shown in figure 4.3 As seen in this figure the 60 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2 and 4 training sample

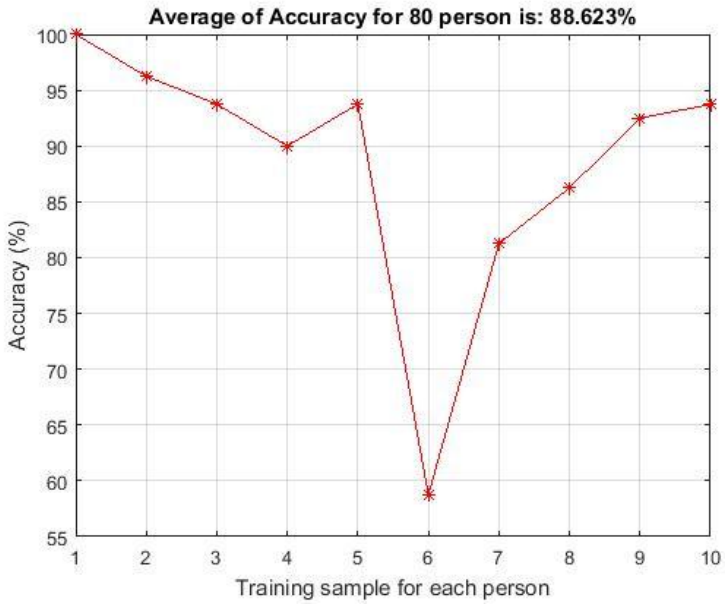

Figure 4.4. Accuracy of proposed method for 80 person

The accuracy of proposed method is shown in figure 4.4 As seen in this figure the 80 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2 and 3 training sample.

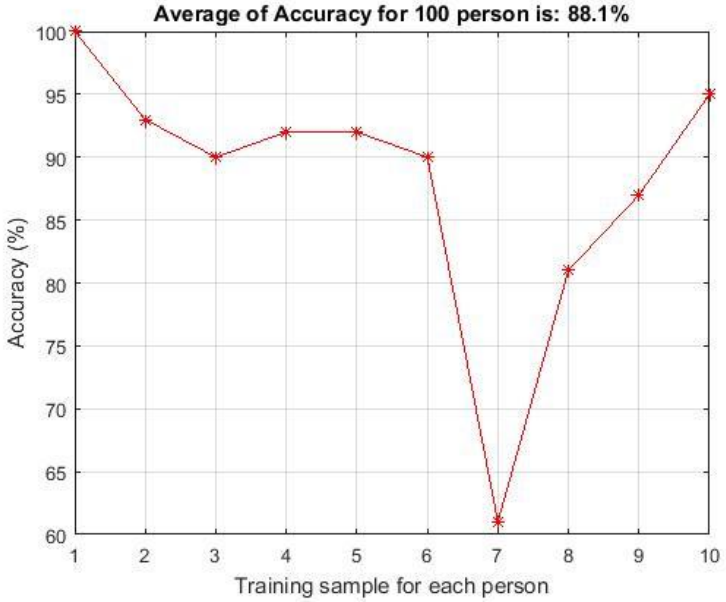

Figure 4.5. Accuracy of proposed method for 100 person

The accuracy of proposed method is shown in figure 4.5 As seen in this figure the 100 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2, 4,5,10 training sample.

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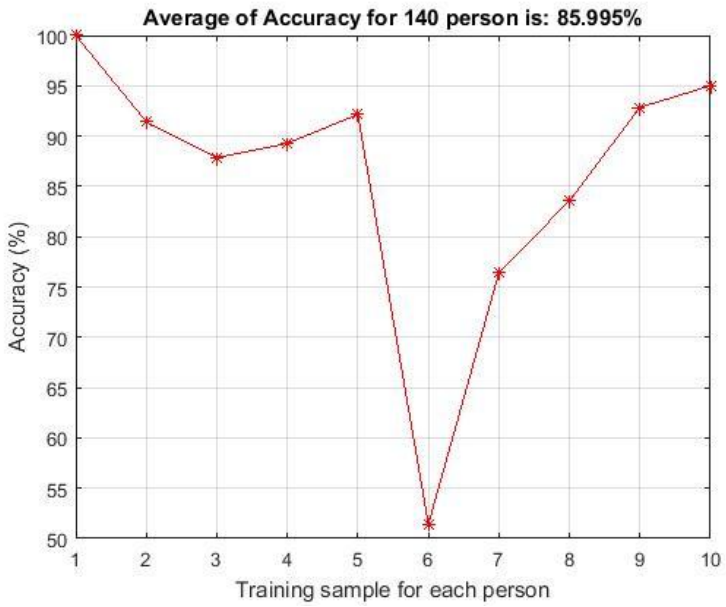

Figure 4.6. Accuracy of proposed method for 140 person

The accuracy of proposed method is shown in figure 4.6 As seen in this figure the 140 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2 5,9,10 training sample.

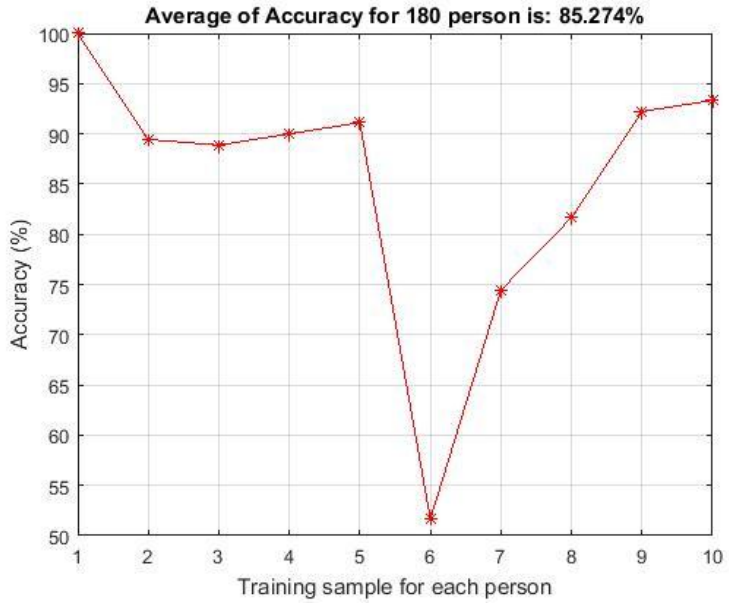

Figure 4.7. Accuracy of proposed method for 180 person

The accuracy of proposed method is shown in figure 4.7 As seen in this figure the 180 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 4, 5,9,10 training sample.

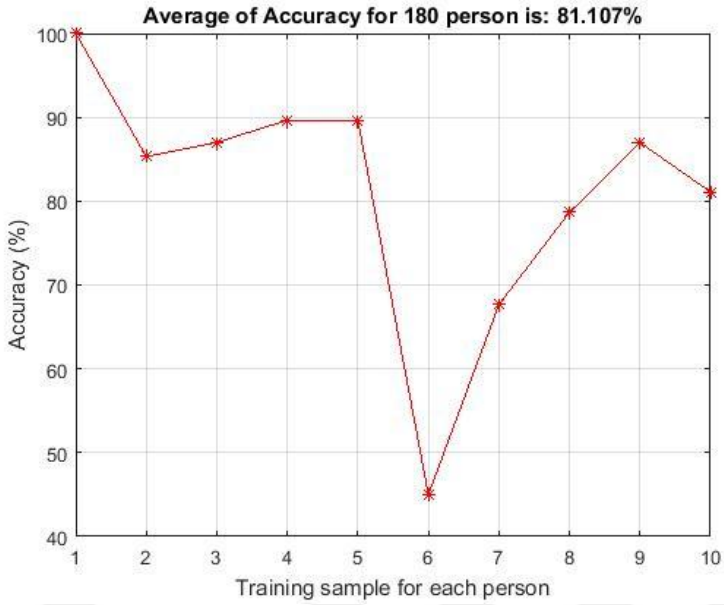

Figure 4.8. Accuracy of proposed method for 300 person

The accuracy of proposed method is shown in figure 4.8 As seen in this figure the 300 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 4, 5 training sample.

4.2 THE FEATURES OF LBP

Table 4.2 This table contain LBP features, 10 images for one person where LBP extract 59 features for each images so according this technique we can get 59 features for one image moreover each person has 10 images this means one person has 59 x 10 = 590 features.

Table 4.2 LBP Features

LBP features												
image	1	2	3	4	5	6	7	8	9	10	11	12
1	0.3277	0.0511	0.0162	0.1285	0.0159	0.0489	0.0144	0.118	0.0114	0.0386	0.0473	0.0399
2	0.3165	0.0541	0.0127	0.1241	0.011	0.0547	0.0095	0.131	0.0123	0.0313	0.044	0.0421
3	0.3536	0.0575	0.013	0.1083	0.0113	0.0571	0.01	0.1096	0.0116	0.0376	0.0344	0.0336
4	0.3277	0.0566	0.0085	0.1165	0.0098	0.0526	0.0112	0.1067	0.0139	0.0399	0.0414	0.041
5	0.3284	0.0708	0.0115	0.1068	0.0127	0.0608	0.0115	0.1174	0.0125	0.034	0.0325	0.0334
6	0.336	0.0629	0.0108	0.1113	0.0122	0.0529	0.0137	0.1221	0.0138	0.0382	0.0346	0.0357
7	0.3338	0.0547	0.0145	0.1164	0.0119	0.0478	0.0127	0.1258	0.0173	0.0329	0.0391	0.0367
8	0.3404	0.0498	0.0145	0.1239	0.013	0.0508	0.0126	0.1216	0.0179	0.0352	0.0381	0.0361
9	0.3452	0.0499	0.0153	0.1245	0.0127	0.0436	0.0136	0.1138	0.0181	0.0308	0.0366	0.0357
10	0.3447	0.0527	0.009	0.1174	0.0133	0.0477	0.0099	0.1261	0.0142	0.0323	0.0353	0.0304
image	13	14	15	16	17	18	19	20	21	22	23	24
1	0.031	0.034	0.042	0.042	0.03	0.091	0.026	0.063	0.048	0.089	0.025	0.065
2	0.03	0.031	0.038	0.042	0.035	0.087	0.021	0.065	0.047	0.078	0.021	0.074
3	0.032	0.029	0.037	0.034	0.03	0.065	0.018	0.049	0.037	0.07	0.019	0.057
4	0.035	0.034	0.044	0.042	0.034	0.084	0.019	0.067	0.04	0.086	0.022	0.072
5	0.027	0.032	0.042	0.044	0.031	0.07	0.019	0.052	0.034	0.071	0.021	0.071
6	0.029	0.026	0.032	0.035	0.037	0.073	0.022	0.056	0.041	0.069	0.022	0.06
7	0.029	0.029	0.032	0.041	0.033	0.069	0.02	0.048	0.035	0.065	0.016	0.058
8	0.03	0.03	0.036	0.038	0.035	0.088	0.026	0.055	0.04	0.068	0.023	0.052
9	0.033	0.028	0.033	0.04	0.035	0.074	0.017	0.051	0.041	0.06	0.022	0.058
10	0.024	0.023	0.029	0.032	0.032	0.073	0.021	0.047	0.035	0.06	0.018	0.059
image	25	26	27	28	29	30	31	32	33	34	35	36
1	0.058	0.04	0.037	0.084	0.13	0.04	0.028	0.102	0.134	0.037	0.038	0.08
2	0.051	0.046	0.029	0.088	0.115	0.049	0.028	0.116	0.129	0.04	0.034	0.076
3	0.051	0.032	0.032	0.068	0.091	0.043	0.031	0.104	0.093	0.028	0.035	0.066
4	0.053	0.045	0.033	0.077	0.114	0.045	0.029	0.102	0.126	0.033	0.041	0.075
5	0.045	0.042	0.028	0.069	0.089	0.05	0.03	0.098	0.097	0.037	0.032	0.06
6	0.045	0.039	0.027	0.076	0.084	0.047	0.038	0.095	0.108	0.034	0.04	0.067
7	0.049	0.045	0.029	0.071	0.099	0.037	0.035	0.078	0.124	0.031	0.04	0.07
8	0.053	0.052	0.028	0.072	0.113	0.036	0.03	0.082	0.132	0.026	0.036	0.072
9	0.053	0.036	0.025	0.058	0.091	0.03	0.025	0.084	0.111	0.034	0.031	0.06
10	0.049	0.037	0.026	0.058	0.098	0.036	0.023	0.089	0.106	0.03	0.031	0.058
image	37	38	39	40	41	42	43	44	45	46	47	48
1	0.052	0.042	0.044	0.092	0.056	0.047	0.041	0.044	0.05	0.045	0.037	0.05
2	0.047	0.037	0.049	0.092	0.054	0.047	0.038	0.034	0.044	0.046	0.041	0.044
3	0.045	0.029	0.042	0.082	0.055	0.038	0.032	0.033	0.046	0.044	0.04	0.043
4	0.062	0.036	0.044	0.099	0.06	0.042	0.042	0.043	0.047	0.048	0.044	0.042
5	0.051	0.038	0.044	0.08	0.044	0.036	0.039	0.039	0.045	0.053	0.036	0.045
6	0.053	0.045	0.036	0.079	0.059	0.037	0.043	0.04	0.047	0.048	0.037	0.048
7	0.044	0.03	0.04	0.103	0.047	0.038	0.035	0.038	0.045	0.044	0.046	0.045
8	0.053	0.035	0.026	0.085	0.057	0.041	0.032	0.034	0.043	0.041	0.044	0.048
9	0.047	0.03	0.036	0.084	0.051	0.035	0.034	0.034	0.043	0.043	0.039	0.044
10	0.049	0.034	0.039	0.079	0.05	0.037	0.032	0.034	0.037	0.042	0.043	0.047
image	49	50	51	52	53	54	55	56	57	58	59	
1	0.057	0.033	0.038	0.025	0.113	0.033	0.035	0.032	0.122	0.45	0.689	
2	0.059	0.027	0.042	0.03	0.105	0.035	0.051	0.031	0.108	0.464	0.69	
3	0.045	0.028	0.051	0.031	0.101	0.028	0.048	0.035	0.097	0.471	0.703	
4	0.05	0.03	0.041	0.032	0.102	0.033	0.039	0.031	0.105	0.461	0.694	
5	0.051	0.033	0.05	0.03	0.092	0.036	0.054	0.034	0.096	0.473	0.708	
6	0.052	0.035	0.046	0.031	0.089	0.034	0.052	0.029	0.099	0.476	0.7	
7	0.047	0.029	0.042	0.028	0.112	0.031	0.038	0.038	0.12	0.456	0.709	
8	0.051	0.03	0.036	0.031	0.1	0.032	0.04	0.038	0.119	0.473	0.689	
9	0.045	0.031	0.035	0.025	0.1	0.033	0.041	0.036	0.115	0.471	0.706	
10	0.054	0.027	0.036	0.026	0.105	0.028	0.041	0.028	0.109	0.476	0.703	

4.3 THE FEATURES OF GLCM

Table 4.3 this table contains GLCM features 4 function(Contrast, Correlation, Energy, Homogeneity) for one person with 10 images for same person

Table 4.3 GLCM features 4 function

GLCM features				
image	1	2	3	4
1	0.172244	0.662102	0.401315	0.914042
2	0.149176	0.708662	0.40215	0.925412
3	0.169722	0.680679	0.356947	0.915221
4	0.155143	0.661301	0.424168	0.922429
5	0.163632	0.696096	0.364446	0.918184
6	0.134412	0.736521	0.398985	0.932794
7	0.145054	0.74042	0.37028	0.927473
8	0.174274	0.692283	0.359696	0.913027
9	0.134289	0.739241	0.401543	0.932856
10	0.117188	0.772584	0.410275	0.941406

4.4 THE RESULTS OF GLCM, LBP AND WD METHODS

In this way wavelet transformation algorithm has been added (WD) to first way ,which contains two algorithm (GLCM, LBP) .we used (WD) in order to improve the results of first way through compression the images and add more extract features ,where the wavelet transformation has (32 features) as a show in (table.5) .moreover, we combine between three algorithm (WD,CLCM.LBP) , where we got the results as a show in the (Table.4) , this way got total of accuracy (73.038 %) for 20 person each person has 10 image , 9 image training and one image test , but the first way the total of accuracy was (87.44test %) for 300 person each person has 10 images , 9 image training and one test image.

Table 4.4 This table explain total training sample and identification accuracy for each person through (**GLCM, LBP and WD**) methods, also we can the average total accuracy for persons

Table 4.4 identification accuracy (GLCM, LBP and WD)

Person	Training sample										Average
	1	2	3	4	5	6	7	8	9	10	
10	100	90	90	90	100	40	60	50	60	60	74
11	100	90.90	90.90	90.90	100	45.45	63.63	54.54	63.63	63.6	76.35
12	100	91.66	91.66	91.66	100	50	66.66	58.33	66.66	66.66	78.32
13	100	84.61	84.61	84	100	46.15	61.53	69.23	61.53	61.53	75.31
14	100	71.42	85.71	78.57	100	50	64.28	64.28	64.28	50	72.85
15	100	73.33	86.66	80	99	53.33	66.66	66.66	66.66	53.33	74.56
16	100	73.33	86.66	80	100	53	66	66.66	66.66	53.33	74.56
17	100	76.47	88.23	82.35	100	47.05	70.58	64.70	64.70	52.94	74.70
18	100	77.77	83.33	83.33	99	44.44	55.55	61.11	44.44	44.44	69.34
19	100	78.94	84.21	78.94	100	47.36	52.63	57.89	42.10	36.84	67.89
20	100	75	80	80	95	50	55	55	40	35	66.5
											73.038

4.5 THE FEATURES OF WAVLATE

Table 4.5 this table contain Wavelet Transforms features 4 function(32 features)for one person with 10 images for same person

Table 4.5 Wavelet Transforms features

wavlate features												
image	1	2	3	4	5	6	7	8	9	10	11	12
1	0.553	0.515	0.542	0.499	9.492	11.36	13.29	15.5	1.014	0.857	0.967	0.804
2	0.54	0.509	0.528	0.499	6.88	8.621	9.647	10.8	0.956	0.831	0.91	0.797
3	0.438	0.406	0.421	0.392	7.158	10.37	11.7	12.73	0.627	0.546	0.588	0.518
4	0.568	0.533	0.55	0.517	5.688	7.445	8.345	8.934	1.078	0.922	1.001	0.865
5	0.354	0.326	0.34	0.315	8.194	11.42	13.44	15.2	0.456	0.403	0.434	0.386
6	0.505	0.47	0.485	0.454	6.054	8.995	10.43	11.47	0.826	0.709	0.762	0.664
7	0.44	0.407	0.424	0.394	8.088	11.71	13.89	15.46	0.628	0.545	0.593	0.519
8	0.491	0.464	0.475	0.435	10.45	12.94	15.61	18.42	0.778	0.689	0.731	0.616
9	0.529	0.497	0.508	0.476	5.699	7.843	9.409	10.42	0.907	0.785	0.833	0.722
10	0.511	0.478	0.489	0.458	5.396	7.991	9.78	10.76	0.842	0.728	0.77	0.67

wavlate features												
image	13	14	15	16	17	18	19	20	21	22	23	24
1	0.31	0.269	0.298	0.254	0.678	0.634	0.664	0.612	1.526	1.632	1.768	1.951
2	0.295	0.262	0.282	0.252	0.684	0.641	0.671	0.627	1.309	1.434	1.52	1.623
3	0.195	0.168	0.181	0.158	0.623	0.574	0.606	0.558	1.502	1.753	1.846	1.934
4	0.326	0.288	0.306	0.272	0.703	0.656	0.687	0.642	1.166	1.31	1.389	1.455
5	0.13	0.111	0.121	0.103	0.574	0.527	0.552	0.51	1.718	1.958	2.121	2.232
6	0.258	0.225	0.239	0.21	0.675	0.621	0.645	0.602	1.254	1.503	1.63	1.718
7	0.196	0.169	0.183	0.159	0.624	0.571	0.6	0.555	1.568	1.845	2.016	2.117
8	0.245	0.219	0.23	0.193	0.644	0.6	0.622	0.568	1.69	1.846	2.069	2.3
9	0.282	0.249	0.261	0.229	0.688	0.635	0.661	0.615	1.205	1.4	1.546	1.639
10	0.264	0.231	0.242	0.212	0.682	0.632	0.649	0.606	1.191	1.407	1.59	1.671
image	25	26	27	28	29	30	31	32				
1	0.955	0.912	0.955	0.912	0.563	0.543	0.557	0.535				
2	0.955	0.912	0.955	0.912	0.503	0.51	0.511	0.509				
3	0.955	0.912	0.955	0.912	0.366	0.376	0.377	0.375				
4	0.955	0.912	0.955	0.912	0.602	0.537	0.596	0.575				
5	0.955	0.912	0.955	0.912	0.296	0.3	0.301	0.299				
6	0.955	0.912	0.955	0.912	0.492	0.5	0.503	0.5				
7	0.955	0.912	0.955	0.912	0.321	0.33	0.333	0.329				
8	0.955	0.912	0.955	0.912	0.45	0.449	0.448	0.448				
9	0.955	0.912	0.955	0.912	0.382	0.397	0.398	0.397				
10	0.955	0.912	0.955	0.912	0.412	0.424	0.424	0.423				

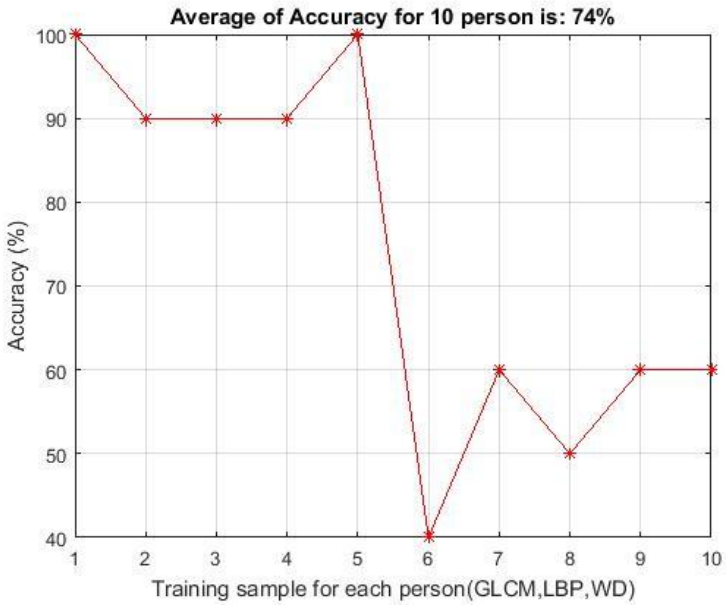

Figure 4.9. Accuracy of proposed method for 10 person

The accuracy of proposed method (***GLCM, LBP and WD***) is shown in figure 4.9. As seen in this figure the 10 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2, 3 4 and 5 training sample

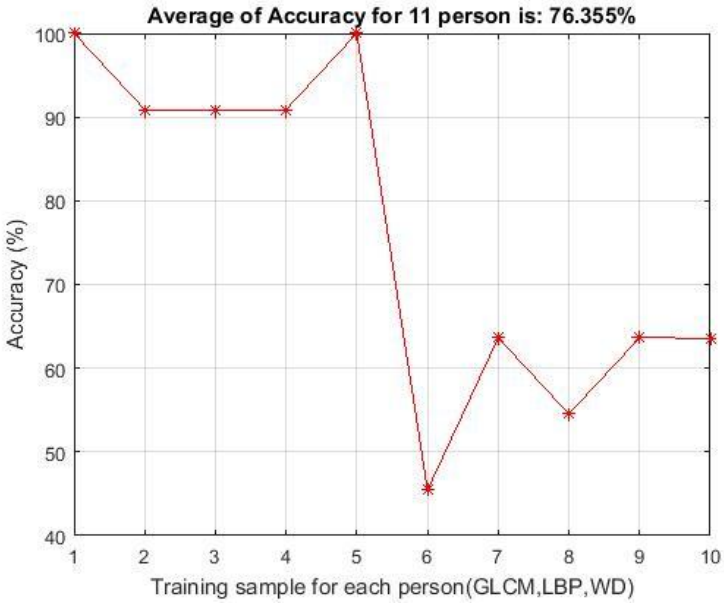

Figure 4.10. Accuracy of proposed method for 11 person

The accuracy of proposed method (***GLCM, LBP and WD***) is shown in figure 4.10. As seen in this figure the 11 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 2, 3 4 and 5 training sample

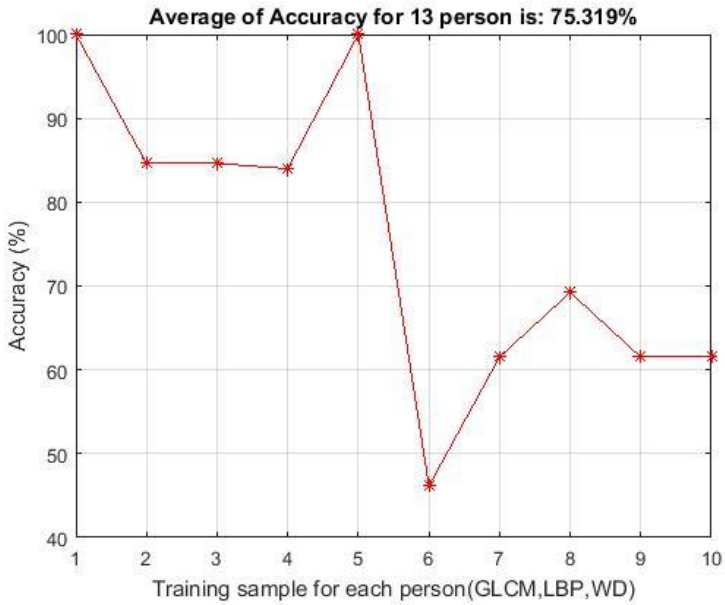

Figure 4.11. Accuracy of proposed method for 13 person

The accuracy of proposed method (***GLCM, LBP and WD***) is shown in figure 4.11. As seen in this figure the 11 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1 and 5 training sample

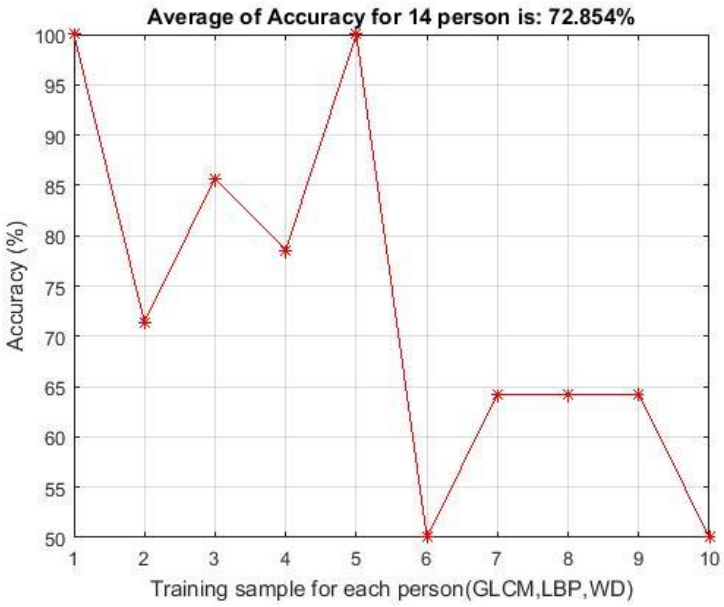

Figure 4.12. Accuracy of proposed method for 14 person

The accuracy of proposed method (***GLCM, LBP and WD***) is shown in figure 4.12. As seen in this figure the 14 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1 and 5 training sample

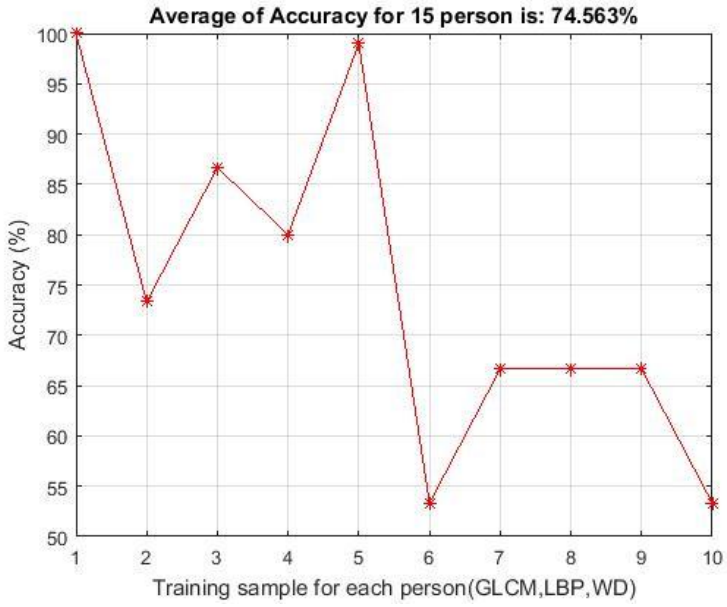

Figure 4.13. Accuracy of proposed method for 15 person

The accuracy of proposed method (***GLCM, LBP and WD***) is shown in figure 4.13. As seen in this figure the 15 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1 and 5 training sample

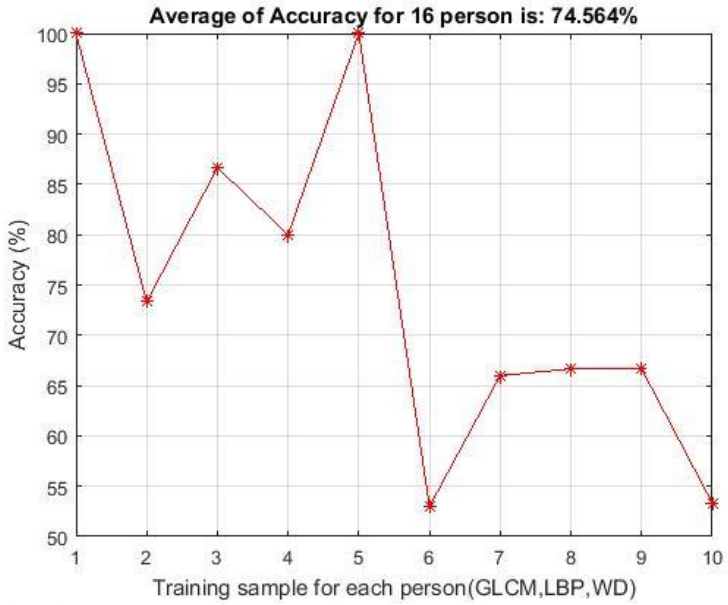

Figure 4.14 Accuracy of proposed method for 16 person

The accuracy of proposed method (***GLCM, LBP and WD***) is shown in figure 4.14 As seen in this figure the 16 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1 and 5 training sample

4.6 THE RESULTS OF LBP WITH DATAMINING METHODS

In this method one of type of data is used mining tools (neural network)with (LBP), which used LBP algorithm in order to extract features from images than using the features as an input data for neural network through layers and hidden layers, we used 8 layers for processing data and training the network, also using one layer as an output with iteration 5000, the numbers of persons 20 person each person has 10 images. this technique for neural network is (supervised learning), through this method we got the results as (Table.6) the total accuracy average is (63.785%), we can see improving in results when we increased the numbers of persons, we can improve the network performance through increasing data training in order to get identification between input data with data store in the network. but we can see that with increasing number persons the accuracy greatly affected as second method.

Table 4.6 This table explains total training sample and identification accuracy for each person through (**LBP with neraul network (ANN)** methods, also we can the average total accuracy for persons, where we used **8** layers input and one layers with **5000** iteration

Table 4.6 LBP with neraul network

Person	Training sample										Average
	1	2	3	4	5	6	7	8	9	10	
10	85.19	23.72	49.27	69.07	54.95	88.32	76.28	35.75	90.70	86	`65.92
11	34.78	63.63	82.95	87.84	84.81	81.66	92.72	83.10	87.29	89.68	78.84
12	34.21	29.21	79.59	65.93	80.39	85.60	82.20	82.91	86	86.96	73.1
13	45.34	49.01	79.15	73.55	74.47	62.88	85.93	82.07	78.49	85.97	71.68
14	16.45	11.95	44.93	75.95	67.89	79.68	74.64	86.68	84.65	77	61.98
15	22.02	37.24	38.23	75.39	81.45	73.13	76.10	76.45	81.34	80.172	64.15
16	0.854	27.57	73.87	51.49	60.43	70.73	70.98	78.17	76.77	80.055	59.09
17	12.49	58.61	42.49	70.42	72.29	65.86	68.50	72.19	71.81	74.60	60.92
18	2.76	15.32	30.48	54.91	56.08	69.62	66.28	78.35	71.07	80.54	52.54
19	37.85	42.31	51.34	56.34	71.36	66.41	72.64	73.50	77.08	73.71	62.25
20	47.96	47.47	49.14	3.07	69.22	73.43	65.68	48.04	63.85	65.18	53.30
											63.785

4.7 THE FEATURES OF WAVLATE

Table 4.7 this table contain matrix features (ANN, LBP),(59 features)for one person with 10 images for same person

ANN LBP matrix features												
image	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0196393	0.0071472	0	0.0140446	0	0.0085793	0	0.0134853	0.0002052	9.44E-05	0	0.0002066
2	0.0181033	0.0087362	0	0.011989	0	0.0075363	0	0.01158	7.89E-05	0	8.10E-05	0.0002019
3	0.0215096	0.0119066	0	0.0140142	4.59E-05	0.0092484	0	0.0133108	9.83E-05	0.0001856	0	0.0001129
4	0.017885	0.0097202	0	0.0128628	0	0.0092102	0	0.0129961	5.55E-05	0.0001671	0	0.0001515
5	0.0194804	0.0095785	8.29E-05	0.0122396	0	0.0082823	0	0.013455	0	0.0001045	0	0
6	0.0185868	0.0083821	0	0.0131074	0	0.0091366	0	0.0140682	0.0001113	0.0001883	0.0001573	9.93E-05
7	0.0154319	0.007332	0	0.0131879	0	0.0078526	4.05E-05	0.0128229	0	0.0001145	9.29E-05	4.23E-05
8	0.0153732	0.0081726	0	0.0135347	0	0.0073989	0	0.0134294	0.0001298	0	0	7.67E-05
9	0.0218051	0.0072632	0	0.0162093	0	0.0070027	0	0.0144167	0.0001321	8.22E-05	0	0.0001021
10	0.0190426	0.0096819	0	0.013545	0	0.007535	0	0.0151467	0	9.63E-05	0.0001058	6.91E-05
image	13	14	15	16	17	18	19	20	21	22	23	24
1	7.47E-05	0.0001231	0.0002115	0	0.0002511	0.0173038	0	0.0137655	8.93E-05	0.0139616	0.0001965	0.0137439
2	0	0	5.62E-05	8.04E-05	4.43E-05	0.0162415	0	0.0130583	5.40E-05	0.0132974	7.06E-05	0.0147445
3	0.0003584	0.0001982	4.28E-05	0	0.0001055	0.0157975	0	0.0134925	0	0.0152943	0.0001449	0.014792
4	0.0001194	0.0001168	6.74E-05	6.61E-05	9.08E-05	0.0173177	0	0.014375	6.86E-05	0.0158691	5.62E-05	0.0135716
5	0.0001952	0	0.0002385	0	0	0.0118448	0	0.011419	5.20E-05	0.0122667	0	0.01275
6	5.72E-05	0.0002571	0.0001288	0	6.84E-05	0.0149044	6.82E-05	0.0119245	0	0.0127641	0	0.0140216
7	0	0	0	0.0002176	6.04E-05	0.0152462	0	0.0116316	0	0.0115029	7.99E-05	0.0130894
8	0	0	6.92E-05	0.0001041	0	0.0142763	4.98E-05	0.0109652	0.0001758	0.0115317	0	0.0108378
9	0.0001451	0	0	0	0.0002024	0.0151424	0	0.012761	0	0.015863	0.0001351	0.0149412
10	5.38E-05	0	6.98E-05	3.96E-05	0	0.0143711	0	0.0108686	0.0001204	0.0131715	0.0002314	0.0113182
image	25	26	27	28	29	30	31	32	33	34	35	36
1	6.50E-05	0.0001348	6.21E-05	0.0011925	0.0002379	0.0003984	0.000533	0.0015029	0.0005046	0.0141707	6.84E-05	0.0246293
2	0	0	0.0001227	0.0009074	0.0003076	0.0003473	0.0001517	0.0017097	0.000479	0.016782	0	0.0266489
3	0.0002277	0.0003887	0	0.0010607	0.0002978	0.0005223	0.0005182	0.0016991	0.0007041	0.0137831	0	0.023594
4	7.15E-05	8.66E-05	6.15E-05	0.0006135	0.0007138	0.0004237	0.0003411	0.00141	0.0008132	0.0149128	0	0.0239839
5	8.77E-05	0.0003833	5.34E-05	0.0004049	0.0005454	0.0004165	0.0001796	0.0006842	0.0008512	0.0158436	0	0.0181309
6	0	0.0003077	0	0.0006808	0.0003343	0.0003597	0.0005528	0.0010782	0.0007109	0.0159036	0	0.0183692
7	0	0	0	0.0003877	0.0005684	0.0007856	0.0007385	0.0005487	0.0006336	0.0163946	5.20E-05	0.0223073
8	0.0001456	6.34E-05	0.0002255	0.0006932	0.000545	0.0005817	0.0003658	0.0006004	0.0005108	0.0140895	6.54E-05	0.0179871
9	0.0001829	0.0001568	0	0.0005024	0.0005849	0.0006248	0.0003979	0.00081	0.0005095	0.0179106	0	0.0230095
10	0	0.000183	5.42E-05	0.0008562	0.0008671	0.0007947	0.0002418	0.0009301	0.0010607	0.0162652	0	0.0215171

image	37	38	39	40	41	42	43	44	45	46	47	48
1	8.94E-05	0.013513	7.19E-05	0.0268992	0	0.0008029	0.0003332	0.0005442	0.0010709	0.0009112	0.0009573	7.64E-05
2	0	0.0159278	0.0003344	0.0273123	0	0.0008271	6.37E-05	0.0004056	0.0006391	0.0004141	0.000727	7.89E-05
3	5.61E-05	0.0137111	6.34E-05	0.0237858	0	0.0005571	0.0003677	0.0008151	0.0012081	0.0005843	0.000687	0.0005156
4	5.86E-05	0.0170524	0	0.0264783	0	0.0008336	0.0001544	0.0001337	0.0004758	0.0005821	0.0007222	7.65E-05
5	0.0002262	0.0138763	6.32E-05	0.0234415	0	0.000591	9.13E-05	0.0006877	0.0010061	0.0007028	0.0006079	8.59E-05
6	0	0.0154049	0	0.0213011	0	0.0004479	0.0001657	0.0008204	0.0006756	0.000895	0.0005819	8.68E-05
7	8.04E-05	0.0132727	0.0001562	0.0225351	0	0.0010825	0.0001444	0.0006421	0.0015176	0.0013541	0.000826	9.76E-05
8	0	0.0112298	0	0.0209549	0.0002745	0.0002382	0	0.0005309	0.0005602	0.0005421	0.0003773	0.0001603
9	0.0001627	0.0137005	0.0001015	0.0260667	0	0.00058	7.15E-05	0.0003879	0.0009077	0.0010513	0.0006515	6.95E-05
10	8.54E-05	0.0159681	6.83E-05	0.0261671	0	0.0008252	8.30E-05	0.0006688	0.0010193	0.001251	0.001152	7.36E-05

image	49	50	51	52	53	54	55	56	57	58	59
1	0.0004213	0.0114019	0	0.0103877	0.0002754	0.0110289	0	0.0123673	7.90E-05	0.9950607	0.0765306
2	0.000549	0.0111994	0	0.0114819	0.0001993	0.0128705	0	0.0134724	0.0004762	0.9958091	0.0647631
3	0.0007719	0.0099394	0	0.0119451	0.0002244	0.012324	0.0002765	0.0127635	7.28E-05	0.9939716	0.089476
4	0.0005826	0.0129075	0	0.0128231	6.36E-05	0.0128881	0	0.0143389	0.000195	0.9949732	0.0758532
5	0.0006047	0.0103826	0	0.0108528	0.0001368	0.0123916	7.30E-05	0.0109901	0.0001892	0.9956182	0.0739118
6	0.0009627	0.0102546	5.96E-05	0.0112489	9.11E-05	0.0119886	0.0001788	0.0119535	0.0003318	0.9957092	0.0718615
7	0.000838	0.012634	0	0.0105512	0	0.013937	0	0.0140155	8.71E-05	0.9955612	0.0733
8	0.0008937	0.0088108	0	0.0108895	4.69E-05	0.0096352	0	0.0117356	9.42E-05	0.9965414	0.0639623
9	0.0014256	0.0135014	0	0.0147809	0.0002007	0.0145608	0	0.0132909	0	0.9944346	0.0816759
10	0.0013547	0.0130283	0	0.0136597	0	0.0138596	0	0.0144249	8.89E-05	0.994272	0.0862326

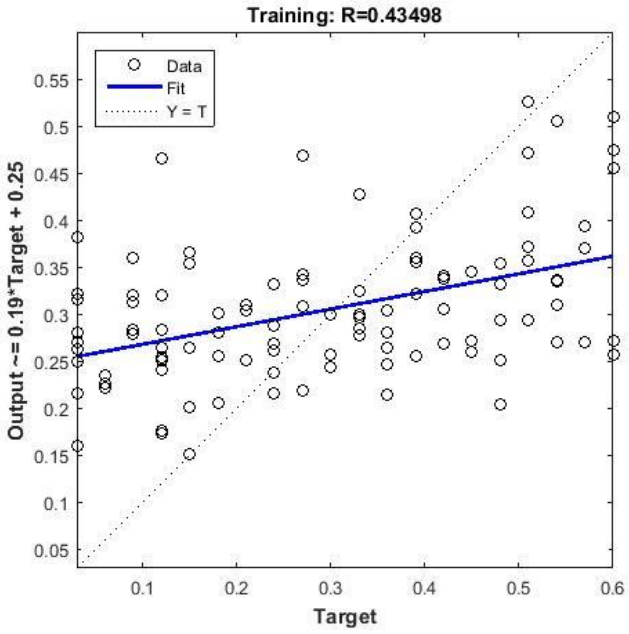

Figure 4.15 ANN Training for 20 persons

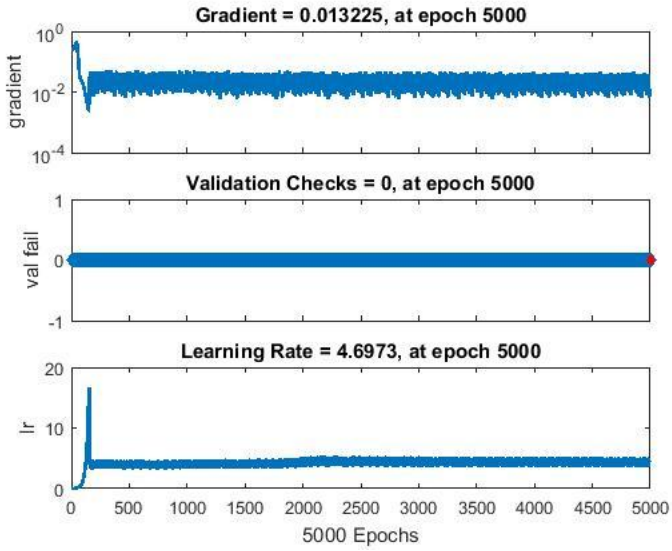

Figure 4.16 ANN Regression for 20 person

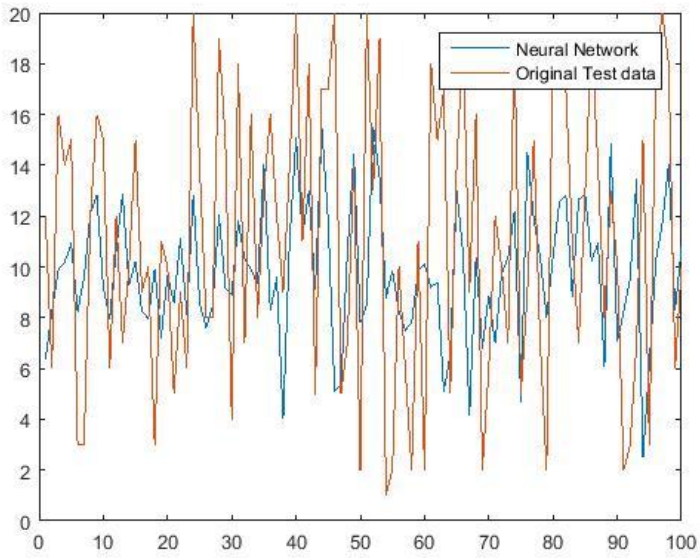

Figure 4.17 Original test data for 20 person

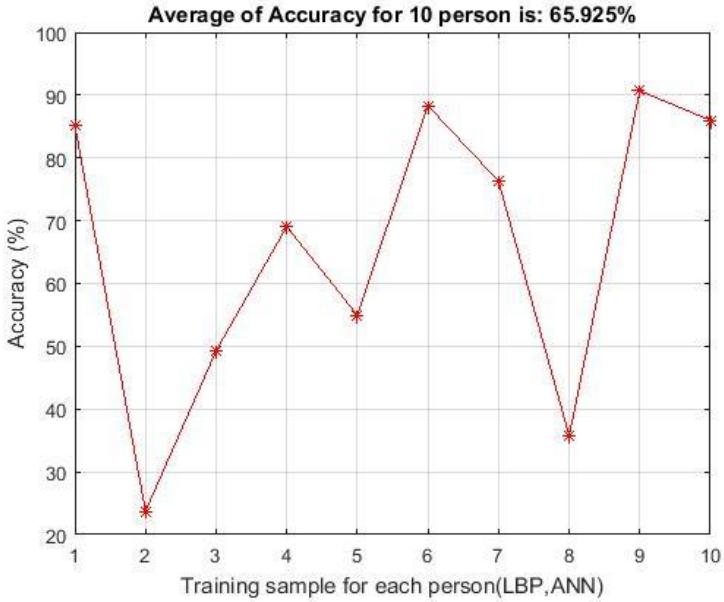

Figure 4.18 Accuracy of proposed method for 10 person

The accuracy of proposed method (***LBP and neural network (ANN))*** is shown in figure 4.17

As seen in this figure the 10 person is used for recognition. For each person about 1, 2, and 10 image is used for training. Also in this figure there are high accuracy for 1, 6, 9 and 10 training sample.

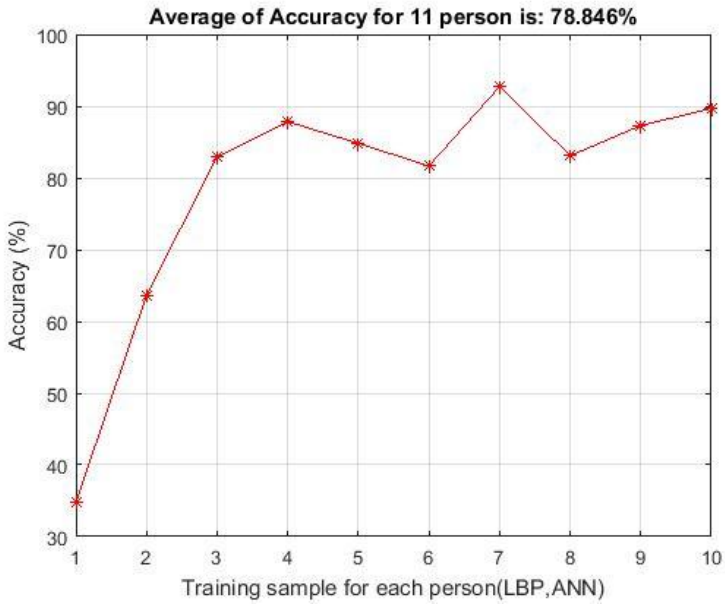

Figure 4.19 Accuracy of proposed method for 11 person

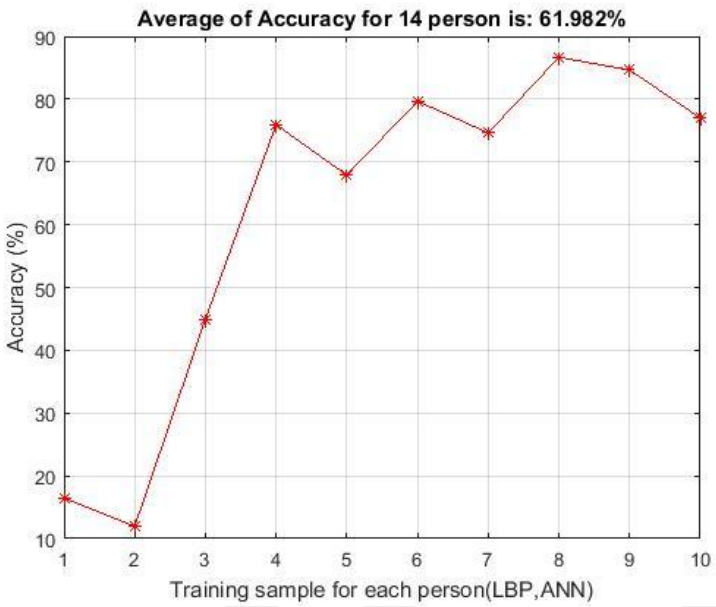

Figure 4.20 Accuracy of proposed Method for (14) person

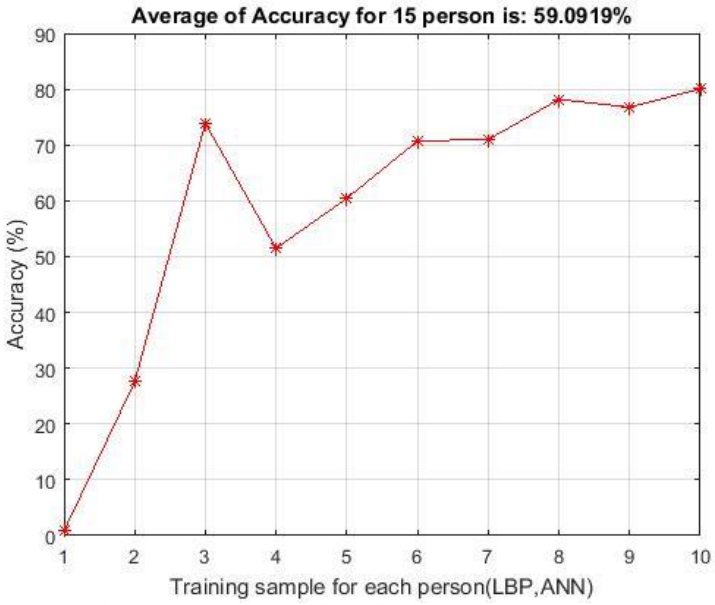

Figure 4.21 Accuracy of proposed Method for (15) person

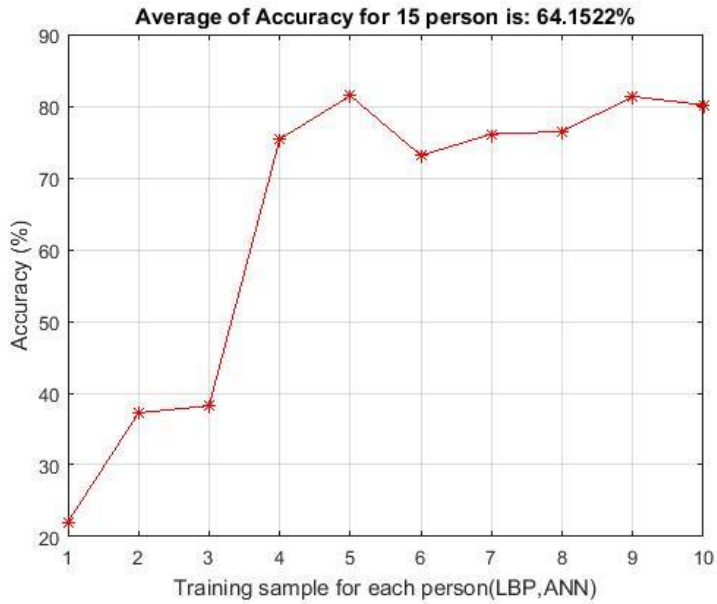

Figure 4.22 Accuracy of proposed method for 16 persons

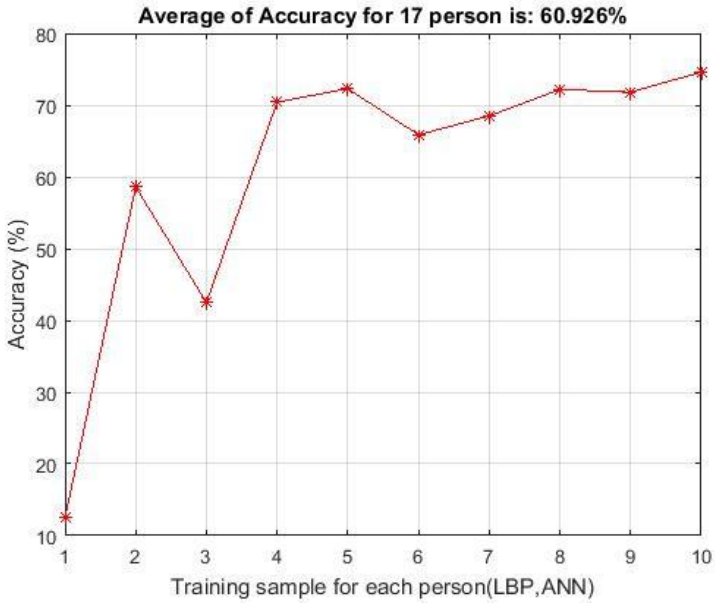

Figure 4.23 Accuracy of proposed method for 17 persons

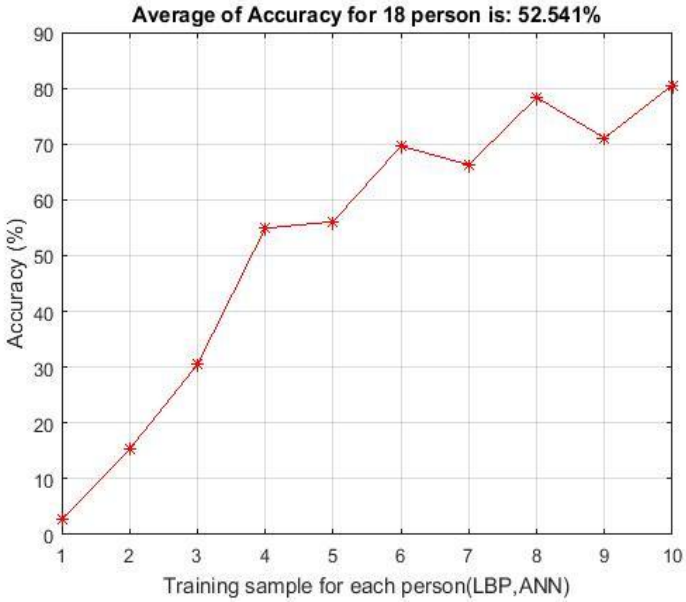

Figure 4.24 Accuracy of proposed method for 18 persons

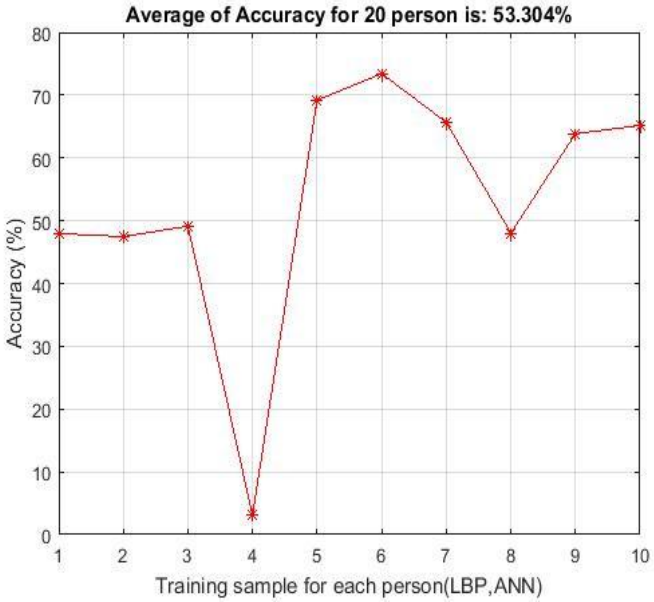

Figure 4.25 Accuracy of propose method for 20 persons

4.8 The total accuracy average for all methods

Table 4.8 The accuracy average for the method (LBP, GLCM), (WD, LBP, GLCM), (LBP, ANN) and number person, images training, images test.

Table 4.8 accuracy average of (LBP, GLCM), (WD, LBP, GLCM), (LBP, ANN)

Method	Number person	Images training	Images test	Time	accuracy
LBP, GLCM	20	9	1	12 hours	87.4425%
WD, LBP, GLCM	20	9	1	1.30 m	73.038%
LBP, ANN	300	9	1	30 sec	63.785%

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 DISCUSSION

There are many systems that require reliable personal recognition in order to determine the identity of an individual and compared with database in system to insure that the rendered services are accessed only by a legitimate user and no one else. There are a lot of examples such as computer systems, laptops, secure access to buildings, and ATMs, cellular phones. In the absence of robust personal recognition schemes. Biometric recognition uses many types methods such as (palm vein, face, eyes, fingerprint), [38]. Palm vein image is one of the best types ways which used in human identification, when using the vascular patterns of individuals as inputs in order to test input data with database , palm vein image is considered as one of the best protection ways when compared with other ways such as finger print or facial featuring. Palm vein method distinct from other ways, with the help of palm vein method we are able to avoid the Fraud and forgery because it uses vascular patterns which is inside our body. Also this method has a lot of features imaging that leads to more accuracy for verification of the person's identity [37]. Wide range of statistical and mathematical methods have been used for measuring identify and verifying the identity of people by measuring image features [39].

In our study ,we have used the palm vein image method to find identification of persons images through training and test images , we have used three different methods in order to acquire the best results. As the first method we used local binary patterns (LBP) and carry level Co-occurrence (GLCM) with 300 person each person has 10 images (9 images training , 1 images test) , also we used Chi-square distance in order to find accuracy through compute the distances between training images with test images for

each iteration. We used (GLCM) to improve (LBP) by four function (Contrast, Correlation, Energy, and Homogeneity). where this method starts by using the GLCM to extract features from image training and put it in the matrix features. also using the LBP to extract features image training and put it in matrix features, through GLCM and LBP, we can get (63) features for each images. After combining them each other matrix features gathers as auniqe opponent Then repeating the same process for images test and using the Chi-square distance to find identification the images. In this method we have gained high accuracy (87.4425%). also we can use a lot of images without greatly affected on accuracy.

The second method, we used the wavelet transformation algorithm based on (GLCM, LBP). We used (WD) in order to compress image and extract features, where we can extract (32 features) by WD method, we combine three algorithms (WD, GLCM, LBP) and used Chi-square distance to compute the distance between images training with test images. We used 20 persons each person has 10 images (9 images, 1 test), we got results as in (table.7) the accuracy is (73.038%), but this method is great affect when increase numbers persons if we compared with first method.

The third method, we used one of type data mining tools neural network(ANN) supervisor learning with local binary patterns (LBP), we used (LBP) to extract features than using this features as data input for neural network. Where used 8 layers and 1-layer output and 5000 iterations in this network. From the results as in the (table .6), we can understand that with increased number of training images we can get a good result. However, with increase the number persons this greet effect on accuracy. The average accuracy was (63.785). it is no good if compared with first method or second method.

5.2 CONCLUSION

Palm vein image is one of the most important methods which is used in identification and verification of individuals. As, palm vein imaging has power and high security, with palm vein image forgery and deception is not easy. For these reasons, palm vein image

is used in many applications such as computer systems, laptops, secure access to buildings, and ATMs, cellular phones, so the researchers cared too much in this method because they are considered to be one of the best methods of Biometric recognition like fingerprints, facial and eye featuring. Palm vein images has a lot of features that makes it Impossible to have similar features among individuals.

In our study, we have used palm vein image to find identification images for a lot of people, and that is through training the model on the images of persons than using test images to find identification accuracy for this reason, we used three methods, of which relies as the first as application of two algorithms (LBP, GLCM) with 300 persons each person has 10 images 9 raining images and one image for test. by this way we got a good results the accuracy rate was (87.4425%). Also this method does not affect significantly with increase of persons because this method has a lot of features (63 features), GLCM (4 features), LBP (59 features). For this reason, this method considers best way.

In the second method we have added the wavelet algorithm to the first method in order to compress the images and extract more features and combine them with LBP and GLCM. The accuracy rate was (73.038%) with 20 persons. this method is affected with the increase of the persons. The third method we have used is one type data Ming tools (neural network, SOM) with LBP, where we used network with 8 layers for processing and one layer to output with 5000 iterations, also we have questioned 20 persons. the accuracy rate was (63.785). For this reason, first method can be considered as the best technique for our study.

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