An Approach for Fingerprint Feature Extraction using Bit Plane and Classification with ANN

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Abstract: Fingerprint recognition is one of the Secure and reliable method of the biometric identification as each individual has unique and unmatched fingerprint pattern. A fingerprint image is treated as a textured image. The important part of the recognition system is the extraction of the features. So in fingerprint recognition the extraction of the feature for further matching and verifying the person identity plays an important role .Traditionally various techniques like Minutiae, Orientation maps, Pattern Matching etc were used for the feature extraction process. Still the accuracy of the system was that much improved. The technique used for the feature extraction should be accurate so that the identification is done accurately. So in this research work a new approach is proposed for the recognition of the fingerprint for the authentication purpose. This method is considered to be efficient and more accurate than the traditional methods. In this Bit plane feature extraction is used to extract the features from the image that are further used for the matching the features .Along with this the ANN is used for obtaining the results. From the results obtained it is concluded that this method is accurate and efficient than the traditional methods of fingerprint recognition system.

Keywords: Biometric system, fingerprint recognition system, Artificial Neural Network, Bit Plane Feature Extraction.

I. INTRODUCTION

In the conventional security and identification systems, an authorized person has knowledge based proof such as social security number or a password or token based (keys or ID cards). But these prove can easily access by the attacker or breached by others. Because ID cards can be lost, stolen or duplicated as well as it is not unique. These reasons put biometric systems under considerations. Biometric system is not easily duplicated because each individual has their own appearance and unique faces. Thus, biometric recognition or biometric systems are most emerging technology in providing security. Biometric sensors produce digital representation of an individual. Biometric system is a computer system that implements biometric recognition algorithm. Each biometric system performs tasks like sensing, feature extraction, and matching modules. Biometric sensors produce digital representation of an individual person to check their validity. [26] These sensors e.g. fingerprint sensor, digital camera for face extract, capture or scan the biometric trait and produces digital representation.

Finger Print Recognition
In this trait, fingerprints are used as input parameter and then checked it with the one that is already stores in the database. [7] Thus, this recognition helps to identify the identity of the person which means whether it is the authorized person to access the control or not. In the finger print recognition, comparison of several features of print

pattern has been taken. These print patterns include characteristics of ridges and minutiae points. Theses points are having the unique property. To recognize the prints effectively, it must know the structure and the properties of human skin.

Patterns
In the finger print recognition, there are various patterns that are used to recognize or verify the person. There are basically three types of basic patterns of fingerprint ridges.

- Arch: - this type of patterns, ridges enters from one side of the finger, rise in the center forming an arc and then exit from the other side of the finger.
- Loop: - in this type of patterns, ridges enter from one side of the finger, form a curve and exist on that same side rather than from the other side as in Arch.
- Whorl: - in this pattern, ridges are in center point and forms a circle around that point.

Minutiae Features
Minutiae features are present on the fingerprints of the user. The basic features present are ridge ending, bifurcation and short ridge or dot. Point where ridge terminates is known as ridge ending. Those points which are split into two ridges are the points of bifurcation. [13] As it name shows that the shortest dot or ridge in the fingerprint is known as shot ridge or dot or in other words,

shot ridge is basically short in length as compare to other ridge length. Therefore minutiae and patterns are important step or vital information in fingerprint analysis. But it is also the fact that no two fingerprints can be identical or same.
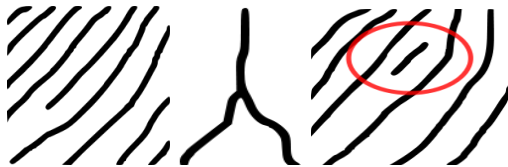
(a) Ridge Ending (b) Bifurcation (c)Short Ridges(Dot)
Fig. 1. Example of minutiae features

Earlier, the fingerprints were matched on the basis of the features or on the basis of the minutiae points. Then, the methods were developed using DWT and DCT techniques to recognize fingerprints. These methods that used Gabor filter technique for matching fingerprints were less efficient and time consuming like the conventional one that matched each line or feature of the fingerprint. The main focus of this study is to extract and match the dataset by applying neural networks along with bit plane feature extraction.

Bit Plane Feature Extraction:
Bit plane feature extraction is a technique which is used for extracting the features of an image. It is quite simple technique to implement and consumes lesser memory for processing. It is applicable in various biometric systems such as iris recognition, face recognition, palm recognition etc. In order to display an image with lesser bits it can be reduced or compressed by applying slicing operation to it. It is also applied to the process of image enhancement for the purpose of extracting some useful or meaningful information from it. With such an augmentation in use of bit plane feature extraction for the purpose of biometric recognition systems the need of overview of implementation or effects of this technique on fingerprint recognition system also arises. The working of bit plane feature extraction is decomposed in the form of bit planes and each bit plane contains of meaningful information. Further this information is used for fingerprint recognition process by reducing the storage requirement for the system.

II. PROBLEM FORMULATION

Biometric recognition systems are used to identify the identity of the person. Biometric systems are using physical traits or characteristics to recognize the person. By this identification, user will allow to access control the access. Different traits are used by different biometric systems. These traits may be fingerprints, face, hand geometry, signature or tone of voice etc. This information is stored in the database which is used for further process. This type of management is known as identity management where the maintaining and destroying identity is used for updating. It plays vital role in case of security because it is undeniable by the person itself. Biometric system works on two parameters such as verification and identification. The basic concern of this system is to ensure that the system works for it is intended too. It should not use the personal information of the person unknowingly. Fingerprint trait is used for recognition of the person and provides authority. To classify the extracted features from the sample various techniques are used. Some of them are:- Orientation maps ,Minutiae feature extraction or Gabor filter etc. Though classifications of the features are important in recognition, thus a proposed method is defined. The proposed method is used due to its advantages (less time consuming and more efficient) over the existing method

III. PROPOSED SYSTEM

Fingerprint recognition refers to the process of matching the finger prints of individuals which are a mark of their unique identity. The methods of finger print recognition have changed over time. Earlier, the fingerprints were matched on the basis of the features or on the basis of the minutiae points. Then, the methods were developed using DWT and DCT techniques to recognize fingerprints. After that the Gabor filter was used for the classification of the features   In Fingerprints of all individuals are different hence, they offer uniqueness to a person and hence, matching fingerprints is important because the results obtained are unique. These methods that used Gabor filter technique for matching fingerprints were less efficient and time consuming like the conventional one that matched each line or feature of the fingerprint.

To overcome these problems of time and efficiency a new technique for recognition of fingerprints is developed. In this a new approach is proposed in which the classification is done by using ANN. These methods took the decisions in intelligent way as these networks are trained on the basis of input parameters and the output for each probabilistic input set is given. These methods are also less time consuming as the output for the input set is already defined. So, the efficiency and results of the developed technique are believed to be better.

IV. METHODOLOGY

The methodology of the block diagram is described below:

1. Initially the image of the finger print is selected from the given set of data. This image that is selected is used for further recognition process. In this approach a set of images dataset is taken whose templates or can say the parameters on which the recognition has to be done.
2. Second step is to normalize those feature values of Gabor so that can be given as an input to the ANN.
3. Next the ANN object is created ,we are using Feed Forward Network.

4. Pass the inputs and the targets to the ANN for the training purpose along with the targets.
5. Next step is testing scenario in which the testing is done with the same parameters extractions which were used in training the ANN.
6. Classify the ANN with the testing features.
7. Finally get the classification results.

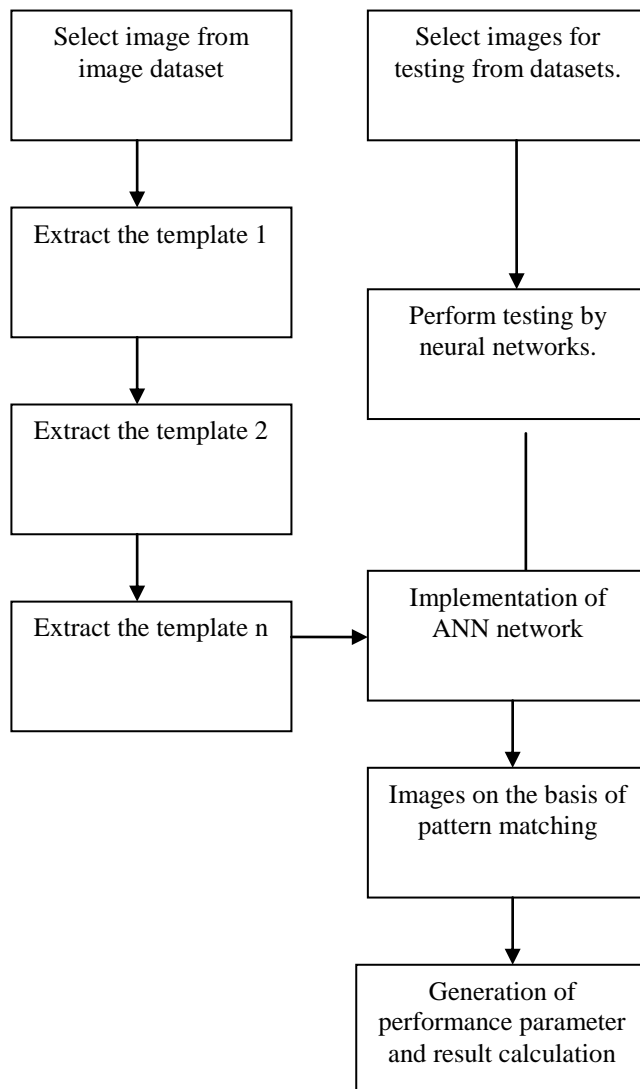Block Diagram**:** The block diagram of proposed work is as follows:

Fig. 2. Block diagram of proposed work

V. RESULTS AND DISCUSSIONS

In this section of Results and discussion we have discussed about the results that were obtained by applying proposed method and the traditional method of fingerprint recognitions system.

Following figure shows two images of fingerprints. First image refers to the original image selected from database

and second image shows the single bit plane image derived from original image. The Bit plane extraction technique is applied to extract the single bit plane image.
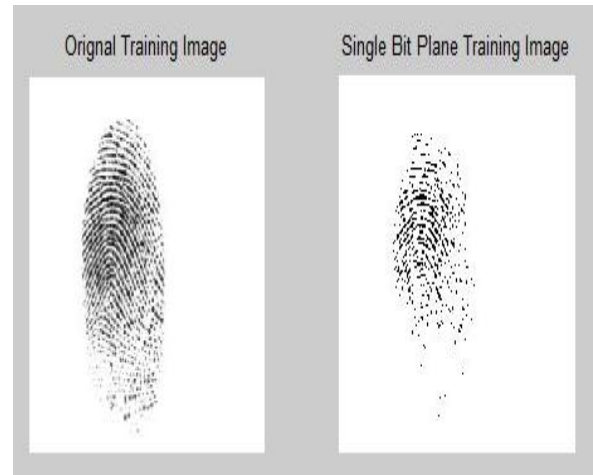

Fig. 3. Original and single bit plane extracted image

Figure below defines the implementation of Artificial Neural Network for fingerprint recognition system. The system explained below defines the training of datasets.
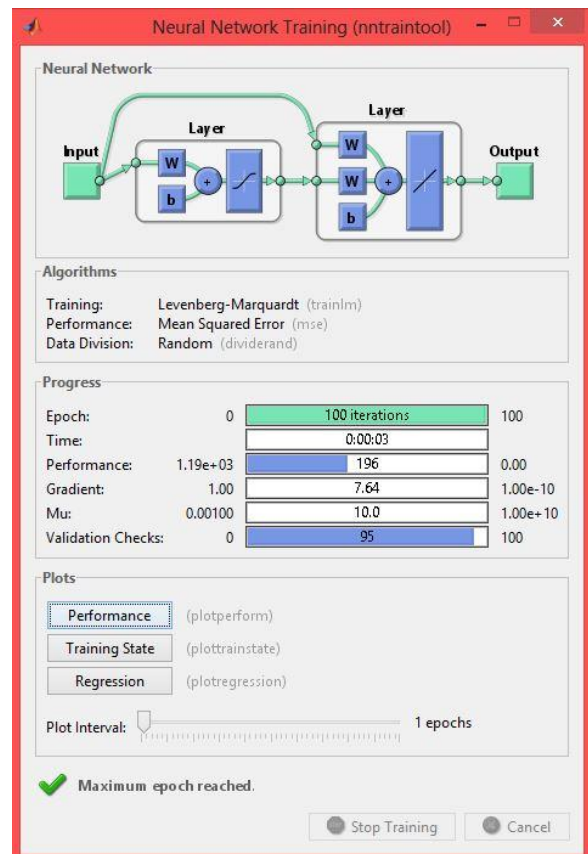

Fig. 4. ANN systems for fingerprint recognition system

The figure below represents the applicability of testing on both of the original and SBP images. The images received after testing process using ANN is shown as below
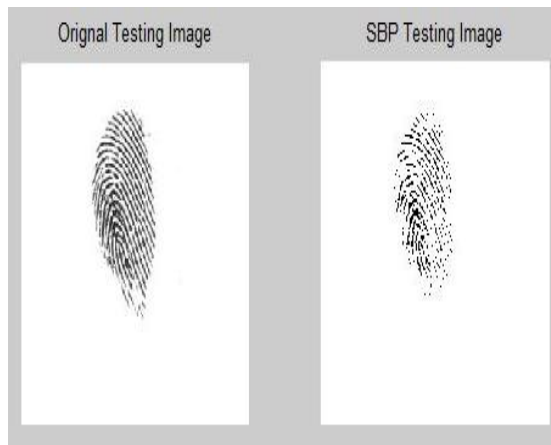
Fig. 5. Tested original and SBP image of fingerprints

The graph below is a comparison graph that compares the Gabor technique, Histogram technique and proposed work. The comparison is done by applying these techniques on various sample data sets. From graph below it is observed that the proposed work has better accuracy level as compare to other two techniques. The comparison is done on the basis of accuracy parameter and the accuracy is calculated in percentage.
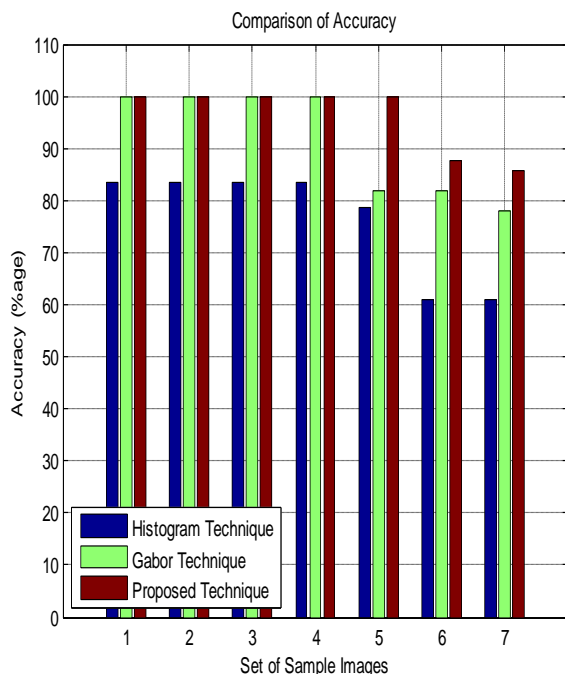

Fig. 6. Comparison graph on the basis of accuracy

VI. CONCLUSION AND FUTURE SCOPE

The feature extraction is the important step of the recognition system. The basic task of the feature extraction should be done with great accuracy and precision for further matching and identification. A feature extraction process is applied to obtain up to three levels of features .in first level at the global level information of the points are obtained ,in second level at local level information

using minutiae the information is gathered and final feature inside the ridges such as width, shape, curvature and dot are extracted . Previously various techniques of feature extraction are studied and from the result obtained it is conclude that choice of techniques at each level depends upon the quality of input image and the content inside image called singular points which are essential in authentication as they are unique of every person. So depending upon these features, a suitable technique need to used. In this work the BP (Bit Plane) feature extraction method is used for the features extraction and ANN is used for the features classification . From the results obtained it is concluded that this method is efficient and accurate than the traditional method of the recognition. The result obtains shows this method is accurate and efficient than the traditional approaches of the fingerprint recognition .In this proposed work ANN is used for the training and testing of the dataset. In future various techniques can be enhanced by using other feature extraction method or by using a hybrid approach to make the process of feature extraction more accurate and reliable.

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