Improve the Performance of Fingerprint Recognition Using Feature Selection and Teacher Learning Based Optimization (TLBO)

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ABSTRACT
Biometric authentication and authorization play an important role in data and network security. Biometric component such as eye face and finger play an important role in security system. The variation behavior of face and iris suffered a problem of recognition and detection. But finger print is most important component of biometric. In this paper we proposed a feature selection cum feature optimization process using wavelet transform function and TLBO algorithm. The wavelet transform function well knows texture feature extraction technique. The extracted feature not contains noised texture data. For the process of optimization used population based TLBO algorithm. In this proposed method used dual fitness function for selection of feature and optimization of feature. The dual fitness function work in terms of average length of template code for recognition process. For the estimation of recognition rate used hamming distance formula for count bit difference of genuine iris and imposter finger template. The recognition rate of feature based technique achieved 99.9 %. For the empirical evaluation of proposed method used MATLAB 7.8.0 software and standard finger print image dataset FCB001collect from university of California. The FCB001 finger print image dataset consist of 500 finger print image data. These dataset is combination of genuine and imposter finger print.

Keywords: - Finger print recognition, Biometric system, Feature Extraction, TLBO.

INTRODUCTION

Biometric is the science and technology of measuring and statistically analyzing biological data. Biometrics System uses physical features such as face, fingerprint, hand geometry, iris, signature, voice, etc, are widely introduced to verify the person identity[3].The biometrics can create a direct connection between users and their identity. It automatically recognizes a person established his/her physiological or behavior characteristics. Since the characteristics used are unique to each individual. In the 19thcentury the chief of the criminal identification of the police department developed the idea of using a number of body measurement to identify criminals, in Paris. The use of biometrics has extended quickly in last decagon and is still growing. In images of faces, European e-passports and fingerprints are stored. Many countries employ biometric information in citizen cards [6]. The Biometric systems used in the real world application. In this model systems rely on the proof of a single source of information for authentication of person. Biometric systems based on single source of information are called Unimodal systems. A unimodal biometric system has sensor module to capture the trait, feature extraction module to process the data to extract a feature set that output compact representation of the characteristic, classifier module to compare the extracted feature set with reference database to generate matching scores and decision module to decide an identity or validate a claimed identity .Though these unimodal biometric systems have many advantages, it has to face with variety problems like noise in sensed data, biometric data can be corrupt by noise due to incomplete acquisition conditions which may lead to false rejections. Non universality, meaningful data from a subset of individuals could not be acquired which results in failure to enroll error [8].Unimodal biometric systems are needed operational advantages related to the performance and accuracy. Fingerprint recognition has been widely use to authentication systems in order to verify the identity claim of an individual [1]. Fingerprint identification is also known as dactyloskopy or also hand identification is the process of comparing two examples of friction ridge skin impression from human fingers, palm or toes method of fingerprinting helps police to investigate crimes during long period of time.

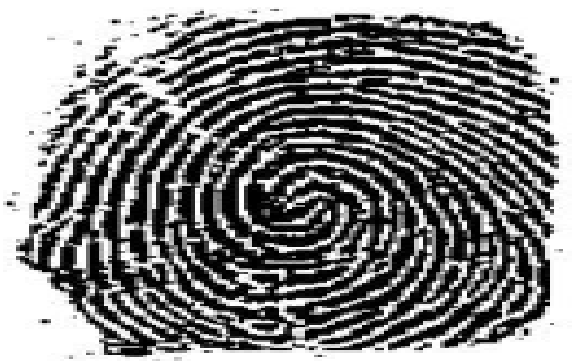

Figure 1: Example of Finger Print.

Current technologies such as smart cards, ID cards and so on are not trustworthy enough for secured electronic transactions. Communication between people or organizations is made simple. Therefore, self verification is a very important issue. Moreover, it is not convenient for users. From above problems the biometrics system uses physical features such as face, fingerprint, hand geometry, iris, signature, voice, etc. Are widely introduced to verify the person identity [3]. Fingerprint recognition are single, and it cannot be changed or copied. Fingerprints are formed in womb in the first month and it will become apparent and maintain the same all along adulthood. When part of the fingerprint is damaged, the remaining part can be used. Even twin don't have the same fingerprint. Therefore, fingerprint plays great role in people identifying. Section II discusses about Feature extraction process, Section III discusses about the proposed methodology. Section IV discusses comparative result analysis. Finally, concluded in section V.

II FEATURE EXTRACTION

Feature extraction can be defined as the act of mapping the image from image space to the feature space. Now days, finding good features that effectively represent an image are still a difficult task. A wide variety of features are used for image retrieval from the database. Image content can differentiate between visual and semantic content. Features usually represent the visual content [10]. Visual content can be further divided into general or domain specific. For example the features that can use for searching would be representing the general visual content like color, texture, and shape. On the other hand, the features that are used for searching human faces are domain specific and may include domain knowledge. If they talk about the semantic content of an image is not easy to extract. Annotation and/or specialized inference procedures based on the visual content help to some extent in obtaining the semantic content. For each image in the image database, its features are extracted and the obtained feature space (or vector) that is stored in the feature database. Most of the applications require that extracted features should remain unchanged means they should be invariant. During the transformation then the current situation of the image is changed. Transformations of image can be both geometric (like rotation and scaling) and/or photometric (change in lighting).but the main objective of the image retrieval is to find the similar contents independent of transformations. There are basically two type of feature local or global. If the features are extracted from the visual content of the entire image, then these features are called global features. Normally global features are used successfully for image retrieval. The easiest and most famous example of global feature is the global color histogram. The main problem that is correlate with the global features is that the resulting description cannot know between different image parts like the object of interest and the background [4]. Therefore, such type of feature is usually not suitable for application like partial image matching and objects .therefore in contrast to global features, it is necessary to extract only local features from regions of interest or objects in the image and use this information to solve problems that are above-mentioned. But again there is some problem with using local feature is that it required preprocessing, namely image segmentation to determine the regions of interest and this is not a simple task.

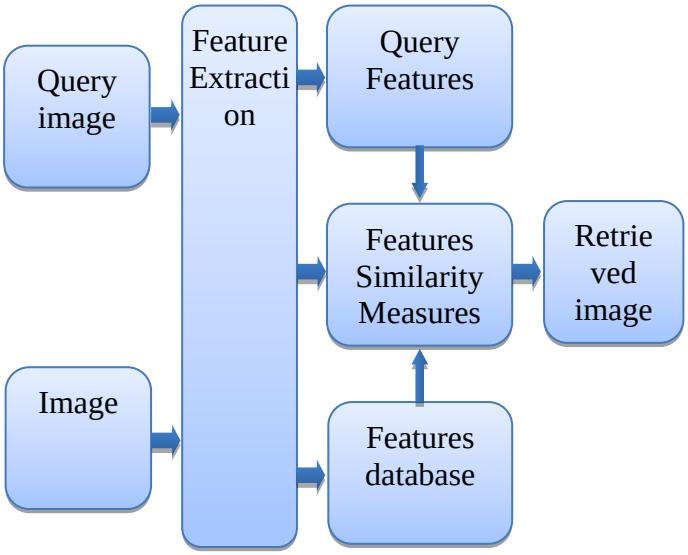

Figure 2: Feature Extraction Process.

Most of the time coarse or inaccurate segmentation is enough for the task of retrieving images in a general database [12]. This kind of segmentation is much easier and faster to produce than accurate segmentation of Regions. Alternative method, one can consider extracting features from patches around image pixels ending up with a set of local feature vectors, each of which describes the local characteristics around an image pixel. By using this way, one can immediately observe that extracting local feature vectors around all image pixels is usually too expensive in terms of extraction time, storage and time needed for matching. One of the most important features of image that make possible the recognition of images by humans is color. Color is a property that depends on the reflection of light to the eye and the processing of that information in the brain. They use color daily to tell the difference between places, objects and the time of day.

III PROPOSED METHODOLOGY

In this paper we proposed a Finger Print recognition method based on feature optimization technique. Now in current research trend of biometric security used the process of feature optimization for better improvement of Finger Print recognition technique. Basically our Finger Print consists of three types of feature such as color pigment, texture and shape and size of Finger Print. The most important feature of Finger Print is color pigment and texture of Finger Print.

Finger Print feature optimization is challenging task in the field of Finger Print recognition. Now optimization processes of Finger Print image need a feature set of Finger Print image data. Now in current scenario various methodology are available for Finger Print feature optimization such as artificial neural network, genetic algorithm, particle of swarm

optimization and many more heuristic algorithm for optimization. We proposed a new method for Finger Print feature optimization based on Teacher Learning Optimization Technique (TLBO). All of the features are dishing based on their distances [17], which is an alternative way to measure the importance of a feature in discriminating two features. The features discriminating based on the equiliden distance formula for finding a similarity of features based texture. After calculation of discriminate we apply TLBO.

1. Assigned the extracted feature matrix of Finger Print image dataset.

➢ Transform data to the format of a feature space that is X is original feature Ris transform feature space such as Xi ^{d} here d is dimension of data.

➢ Conduct scaling on the data

$\alpha =$ $\sum_{i=1}^{m}\sum_{j=1}^{n} sim(Xi, x_j$

here α is scaling factor and m is total data point and k is total number of instant and sim find close point of data.

➢ consider TLBO input as number of student

The population X is randomly initialized by a search space bounded by matrix of N rows and D columns. The jth parameter of the ith learner is assigned values randomly using the equation

$$x_{(i,j)}^{0} = x_j^{min} + rand \times (x_j^{max} - x_j^{mir}\ldots$$

Where, rand represents a uniformly distributed random variable within the range (0,1), and represent the minimum and maximum value for jth parameter. The parameters of ith learner for the generation g are given by

$$X_{(i)}^{g} = \left[x_{(i,1)}^{g}, x_{(i,2)}^{g}, \ldots\ldots\ldots\ldots, x_{(i,j)}^{g}, \ldots\ldots, x_{(i,D)}^{g}\right]$$

➢ Use the best parameter TF and to select optimal feature

The mean parameter Mg of each subject of the learners in the class at generation g is given as

$$M^{g} = \left[m_1^{g}, m^{g}{}_{2}, \ldots\ldots\ldots\ldots, m_j^{g}, \ldots\ldots, m_D^{g}\right]$$

The phase of learner considers the minimum objective function of teacher Xg for given condition.

$$Xnew_{(i)}^{g} = x_i^{g} + rand\,X \left(x_{teacher}^{g} - TFM^{g}\right)$$

TF is the teaching factor which decides the value of mean to be changed. Value of TF can be either 1 or 2. The value of TF is decided randomly with equal probability as,

$$T_F = round[1 + rand(0,1)\{2 - -1\}]$$

➢ Generate optimal feature data.

1. Process the feature vector generated by feature matrix.
2. For all the optimal feature is assigned

Let us consider vector of features c1, c2, c3…….cn

BEGIN

Find vector with no features

C=¢

Find feature at Max length

C=RL(X^{d})

Find the minimum feature length

REPEAT

3. Perform encoding and generate template
4. Result optimal template.
5. Perform hamming distance match score
6. Recognition is perform
7. Exit

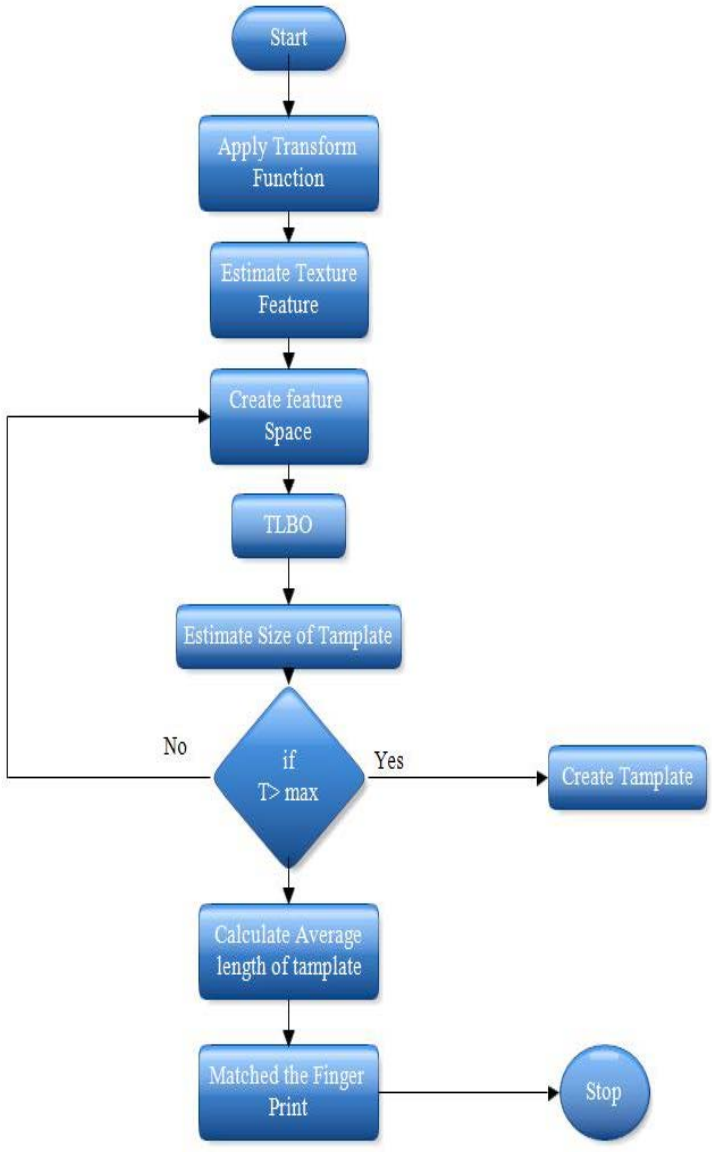

Figure 3: Block Diagram of Proposed Model.

V EXPERIMENTAL RESULT ANALYSIS

In this section discuss the comparative result analysis of previous algorithm with our proposed method used for the performance was evaluated on FVC 2002 DB1A and FVC 2002 DB2A respectively. FVC 2002 DB1A consists of 800 samples which were captured from 100 fingers with 8 samples per finger. These samples have the size388*374 pixels and are generally sorted by the sample quality in descending order. The experimental result partitioned by two methods one is Bloom Filter and another is our proposed method. EER is also calculated by directly using binary template without Bloom filters in order to analyze the impact of applying Bloom filters. The validity of a biometric system cannot be measured accurately, and can only be enumerated on the occurrence of errors like the chance of accepting an intruder i.e. the False Accept Rate (FAR) and conversely the probability of rejecting a genuine individual i.e. False Reject Rate (FRR) which could turn out to be detrimental to any system.

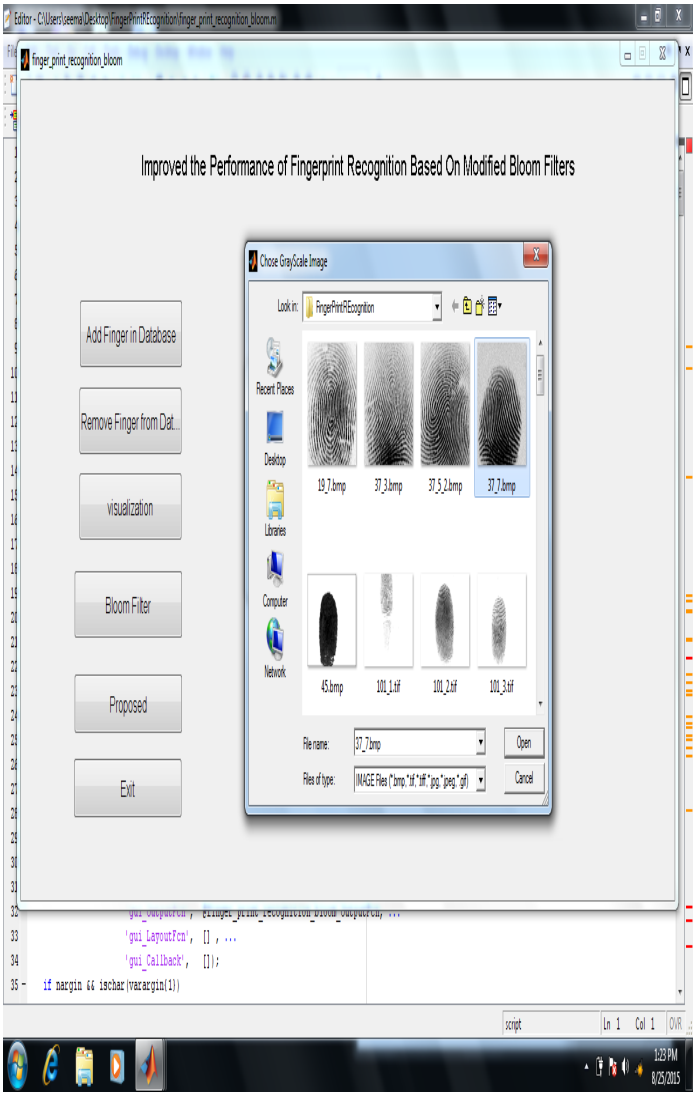

Figure 4: To Shows we Add 5 Finger prints in Database.

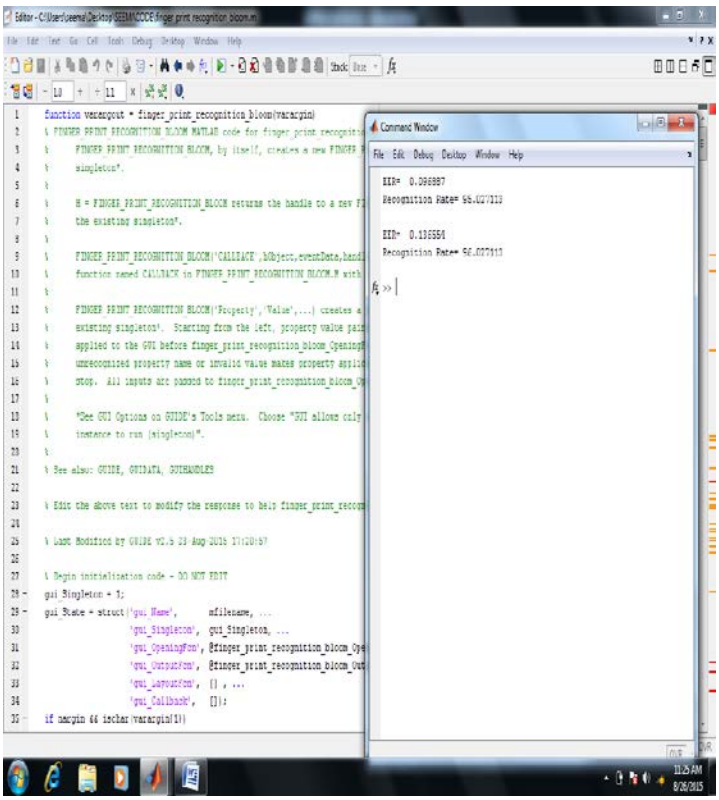

Figure 5: To Shows we Apply Bloom Filter and Proposed Method for 5 Fingers.

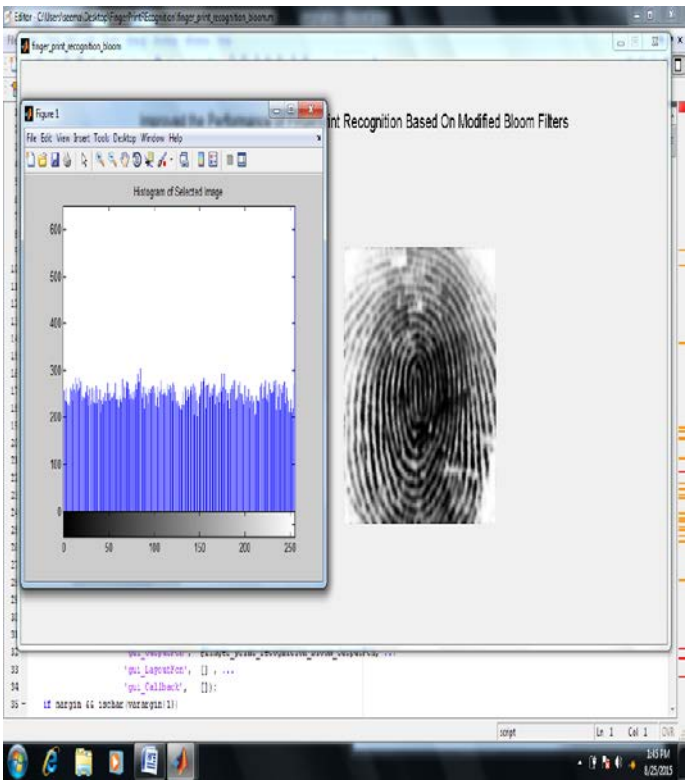

Figure 6: To Visualization the Fingerprint Recognition for 5 Fingers.

NO .OF FINGER SET	METHOD	EER	RECOGNITION RATE
5	Bloom	0.096887	95.027113
	Proposed	0.136554	96.027113
10	Bloom	0.104439	95.019561
	Proposed	0.144106	96.019561
15	Bloom	0.108207	95.015793
	Proposed	0.147874	96.015793
20	Bloom	0.101861	95.022139
	Proposed	0.141528	96.022139
25	Bloom	0.100721	95.023279
	Proposed	0.140387	96.023279
35	Bloom	0.097906	95.026094
	Proposed	0.137573	96.026094
40	Bloom	0.103724	95.020276
	Proposed	0.143391	96.020276

Table 1: Shows the Comparative Value of Bloom Filter and Proposed Method.

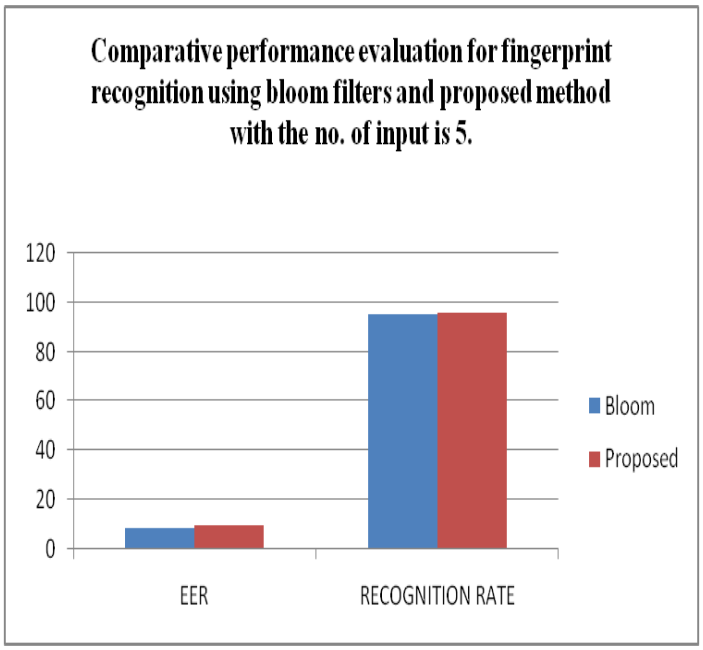

Figure 7: Here we Have to Show that the Proposed Method to Better than the Existing Method and we find the 5 input values in term of less error and higher recognition rate in our method than existing method.

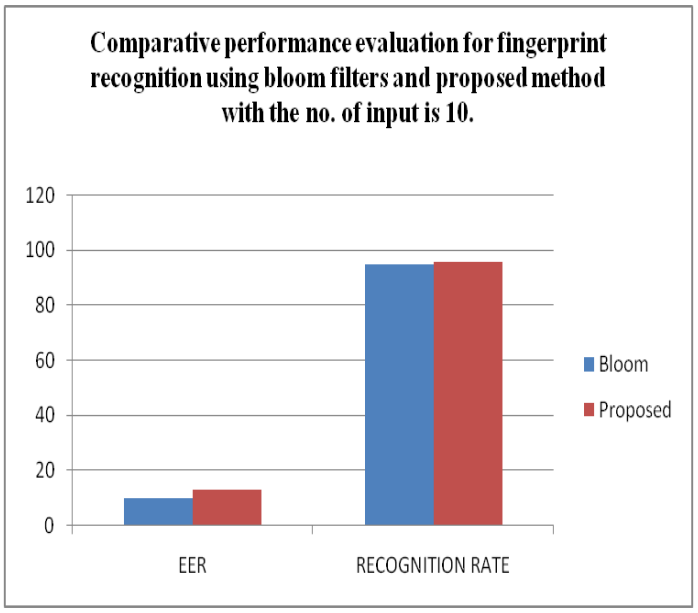

Figure 8: Here we have to show that the proposed method to better than the existing method and we find the 10 input value in term of less error and higher recognition rate in our method than existing method

V CONCLUSION AND FUTURE WORK

In this paper we proposed a feature based finger print recognition system. Feature based finger print recognition system improved the recognition rate of system and reduces the template creation error. The feature extraction process is done by wavelet transform function. Wavelet transform

function well knows texture feature extractor. The extracted feature passes through optimization and selection process, for the optimization and selection process used TLBO algorithm. The optimized template passes the through the recognition process. In the process of recognition measure the hamming difference bit of genuine finger print and imposter finger print. The level of recognition defines by the average length of template. Our proposed method implement in MATLAB 7.14.0 computational software along these method also implement two different methods for finger print recognition. One method is bloom filter method and other one is wavelet based finger print recognition system. The recognition rate of finger print image is very high in compression of bloom filter and wavelet transform. The optimized feature selection process improved the finger print recognition system. The feature selection and feature optimization process used two different fitness functions for satisfying the condition for optimal selection. the dual fitness condition function take more computational time for template generation in future reduce the dual fitness function in single objective function and increase the execution speed of finger print recognition system.

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