Score Level Fusion and Machine Learning Approach Based On Personal Authentication Using Multi-Model Design

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Abstract—Authentication system which relies only on an individual biometric identified in making a personal identification is often not able to meet the preferred performance needs. Identification based on multiple biometrics represents a developing trend. We describe a multi-model biometric system, which integrates fingerprint and speech verification in making a personal identification. In this thesis, multi-modal biometric system integrating fingerprint and speech in making a personal documentation is introduced. The processed information is combined with the help of fusion technique in score level in which feature matrix; each system computes its own matching score and optimizes the feature matrix using BFO. After optimization we can apply the classification technique like SVM. The performance evaluations of proposed method provide preferable false acceptance rate, false rejection, accuracy and precision enjoying efficient recognition in MATLAB environment.

Keywords— Biometric, fusion of modulate, Gamma tone Cepstral Coefficient, Minutia Recognition, Support Vector Machine.

I. INTRODUCTION

Biometrics is a very fast growing technology in today's area for commercial applications. Biometrics technology came into existence in 1879s. It has been discovered by French criminologist for identifying criminals [1].

Biometrics is the science and technology used for measuring, analysing the biological data.In information technology, biometrics usually refers for measuring and analysing human body characteristics such as fingerprints, eye retinas & irises, voice patterns, face designs, and hand measurements, expressly for authentication purposes. Biometric is used for extracting a feature set from the acquired information, & comparing this set along-side to the template set in the database. Biometric fusion can be defined as the use of multiple types of biometric data for improving the performance of biometric systems. A perfect biometric should be single, universal, & permanent above time that is easy to measure also cheap in costs, and have high user acceptance. No single biometric can fulfils all these requirements simultaneously. For instance, fingerprints & retina are known to be highly exclusive, but they require dedicated sensors and are not user friendly. On the other hand, voice & facial geometry are not as exclusive, but they require only a cheap microphone or a camera as a sensor, and they are unobtrusive. Therefore combination of numerous complementary biometrics can provide high recognition accuracy than any individual biometric alone. Multimodal biometric systems perform better than uni-modal biometric systems as it removes the limitations of single biometric system. The most used identification used in criminology is personal identification. The personal identification makes it possible to arrest the criminal in accurate way. Defining the identification of human being that is criminal is very difficult. Biometric system has now been used in the various commercial and forensic applications. These biometrics extremely based on the fingerprints, speech, ear, signs, hand geometry, iris, retina, face, hand vein etc. Earlier most of the biometric systems are uni-model [2].

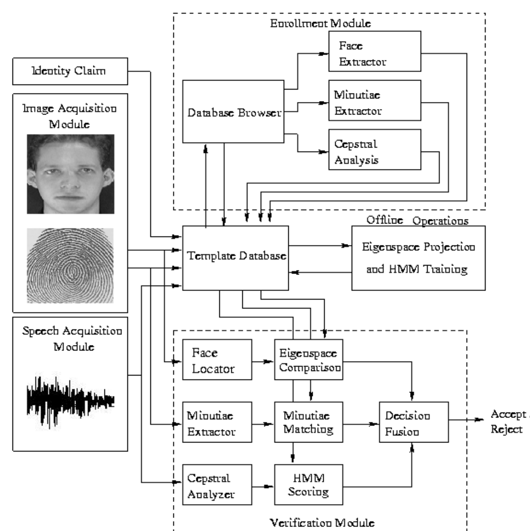

Fig.1: Multimodal Biometric System

The fusion of biometric traits leads to the development of the performances by decreasing the negative results. E.g. fusion of iris & ear is more effective in accordance to the use of only iris or ear modalities. Main benefits of using multimodal systems are reduction in cost & complexity. This is due to the behind characteristics:

- Fusion of modalities must takes place in synchronous manner.
- Fast processing period fusion strategy must have been accepted.
- Modalities are independent to each other.
- Different assurance level: like to recognize the crying speech is much easier in video than in audio.[3]

There are numerous ways of fusion of modalities. It can be done using feature level, decision level etc. fusion of multimodal biometric systems is very difficult. Fusion must takes place in timely manner. The timely completion of tasks makes it much easier for fusion. Due to non-synchronous the level of difficulty in fusion increases. The different modalities used in a fusion process needs to be understood. So mean to find the optimal feature sets required for fusion. If the utmost apposite subset is unavailable, can one usage alternative streams short of much loss of cost-effectiveness & confidence.

II. RELATED WORK

LamisGhoualmi (et.al.), 2015[4]The projected method has been applied on a synthetic multi-modal biometrics database. The latter is shaped from Casia and USTB 2 databases which represent iris and ear image sets respectively. Satrajit Mukherjee (et.al), 2014 [5] Novel adaptive weight and supporter based function mapping the matching scores from dissimilar biometric causes into a single merged matching score to be used by a classifier for further decision making. Differential Growth has been working to regulate these unable parameters with the independent being the minimization of the covering area of the occurrence distributions of open and imposter scores in the fused score space, which are projected by Gaussian kernel density technique to achieve higher level of accuracy. Samarth Bharadwaj (et.al), 2014 [6]Review of the features, strengths, and boundaries of existing quality evaluation technique in fingerprint, iris, and face biometric are also obtainable. lastly, courier set of quality metrics from these three modalities are evaluate on a multimodal database consisting of2D images, to appreciate their performance with deference to match score obtained from the state of the art recognition systems. The study of the characteristic function of excellence and match scores show that a cautious selection of admiring set of superiority metrics can provide more advantage to various applications of biometric excellence. Vincenzo Cont(et.al), 2013 [7]In this section fingerprint and iris based unmoral and multimodal confirmation systems will be describe, analyse and evaluate. To conclude, a proto typed embedded multimodal biometric sensor will be sketch. Software and hardware prototypes have been checked against common and broadly used databases. Sambit Bakshi et al., 2012 [8] achieved classification operation on the detected key points. Each set of the key points of the query image is exposed to nearest national match with respective set of key points of the database image. Hence there are two notches generated by the matching of two classes. This paper also recommends an accurate monotonic function on these dual scores to produce a single score such that the final score value gives rise to better disjunction between unaffected and imposter scores than conservative SIFT.

III. AIM PROPOSED ALGORITHM

The purpose of image fusion in overall is to use images as redundant or complementary sources to extract information which cannot be attained by a single image or which suggestions higher accuracy or reliability for the inspection task. By consuming multiple images, the visual or theoretical restrictions that are often imposed during the image acquisition and dispensation can be avoided. Furthermore, some innovative inspection principles require that images sequence are captured and processed in order to get the anticipated information. The main thought of image fusion is to gather image information obtained by changing one or many imaging parameters, such as the location or spectral response of the camera, the use of divergence filters, the dynamic range or opening settings. By means of suitable techniques of multidimensional image processing or design gratitude in the parameter space of the image series, the information of interest is extracted from the sequence. This material can further be used e.g. for quality assessment, traffic control, driver assistance or reconnaissance.

A. GTCC Algorithm

Gamma tone Cepstral Coefficient (GTCC) technique is based on the gamma tone filter bank, which attempts to model the human auditory system as a series of overlapping band pass filters. LPC is used for both noisy and clean environment, MFCC and GTCC is similar recognition in clean environment and GTCC is better in noisy environment Similar to Mel Frequency Cepstrum Coefficient (MFCC), there is another feature vector called gamma tone Cepstrum Coefficient (GTCC) or Gamma tone [5] Frequency Cepstrum Coefficient (GFCC). MFCC systems usually do not perform well under noisy circumstances because extracted features are distorted by sound, causing mismatched likelihood calculation. By introducing a novel speaker feature, gamma tone Cepstral coefficient (GTCC), based on an auditory periphery model, & show that this feature detentions speaker characteristics and performs substantially better than conventional speaker features under noisy conditions. An essential finding in the study is that GTCC features out-perform conventional MFCC features under noisy conditions. Broadly speaking, there are two major differences between MFCC & GTCC. The obvious one is the frequency scale. GTCC, based on equal rectangular bandwidth (ERB) scale, has finer resolution at low frequencies than MFCC (mel scale). The other one is the nonlinear rectification step prior to the DCT [9]. MFCC uses a log while GTCC uses a cubic root. Both have been used in the literature. In addition, the log operation transforms convolution between excitation source & vocal tract (filter) into adding in the spectral domain. By carefully examining all the differences between MFCC and GTCC, it concludes that the non-linear rectification mainly accounts for the noise robustness changes. In particular, the cubic root rectification provides more robustness to the features than the log. The cubic root operation better might be the case that specific speaker information is embodied complete different energy levels. In a noisy mixture, there are target dominant T-F units or segments indicative of this energy info. The cubic root operation types features scale variant (i.e. energy level dependent) and helps to preserve this information. The log operation, on the other hand, does not encode this information. Thus, GTCC provides more accurate result than MFCC. This study compares the differences between MFCC and GTCC for recognizing emotion from speech [10].

B. Minutia Recognition

The study of the fingerprints originated into the moon bright in the 18th century. Fingerprint matching is one of the oldest forms of the biometric technologies that are being used so extensively. Father of fingerprint matching technique is Francis Galton. Combination of patterns called ridges and valley develop the fingerprints. Single arched section is known the ridges whereas part amongst two adjoining ridges is recognized as valley and ridge termination is known as minutiae. For fingerprint matching mainly two features of minutiae are used:

1. Ridge ending [11]

2. Ridge bifurcation.

Fingerprint matching is very crucial and essential step in biometric technology. Fingerprint matching based on minutiae method is a very popular approach.

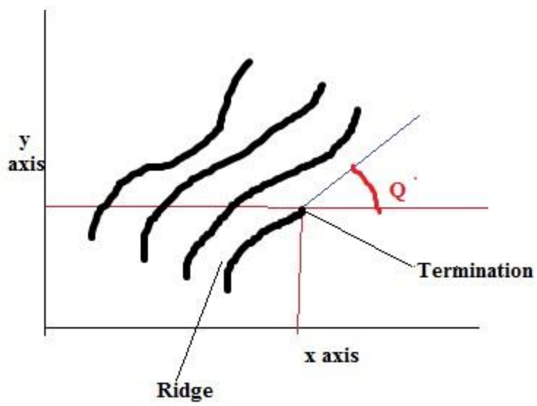

Fig. 2: Terminations and Ridges

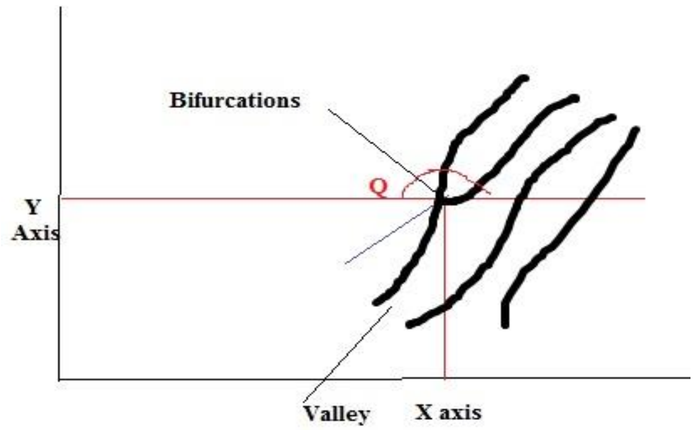

Fig. 3: Bifurcations and Valleys

Any bio metric system follows the same rules and regulation for the authentication system. The first part is called the training part and the second part is called the testing part. The training part involves the following procedures like sensing, feature extraction, saving the extracted features to the database.

C. Edge Detection

It is technique of finding and locating the discontinuities in the image. The discontinuities or gaps are the changes in the pixel intensity values in an image. Earlier there are many methods like 2-D Filter, in which gradients [12] are constructed to get the edges of an image. Operators can be optimized to get vertical, diagonal and horizontal edges. Mainly operators are used for noise removal application.

D. Canny Edge Detection

Canny edge detector is also known as optimal edge detector. In this edges describes boundaries and it is a problem of vital significance in image processing. Edges describe the area with robust intensity contrast that is a jump in intensity from one pixel to another pixel. Edges detect the image significantly. Filter out the useless information and reduces the amount of data. And preserve the important structure properties in an image. Canny edge detector is applied to acquire the edges of the image.[15]

E. Support Vector Machine

Support Vector Machine (SVM) also called Support Vector Networks are supervised learning models that analyze data and recognize styles. SVM models represent examples as point in space mapped in manner that isolated categories examples k is divided by a gap thereby performing linear classification. Apart from this SVMs can also perform nonlinear organization using kernel trick [6].

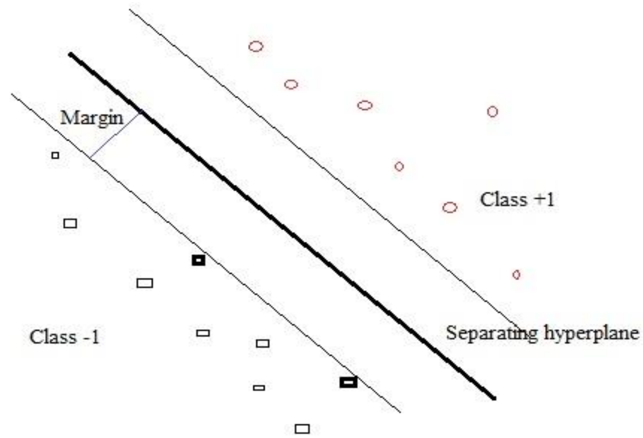

Fig. 4: SVM Working

The main idea of SVM is that; it finds the optimal separating hyper plane such that error for unnoticed patterns is minimized. Consider the problem of separating the set of training vectors belonging to two separate classes [18].

Equation $_{1},_{2}\ldots.x_{n}$

Which are vectors in $\mathbb{R}D$.

We consider a decision function of the following form:

Equation $=wT\varphi\ x+b$

Attached to each observation x_i is a class label, $t_i \in -1, +1$. Without damage of generality, we must construct a decision function such that, $yx_i>0$ for all isuch that $t_i=+1$, and $yx_i<0$ for all isuch that $t_i=-1$. We can combine these requirements by stating,

Equation

$t_i y x_i > 0\ \forall i$

The idea is to extend it to multi-class difficulty is to decompose an M-class problem into a series of two-class problems [9].

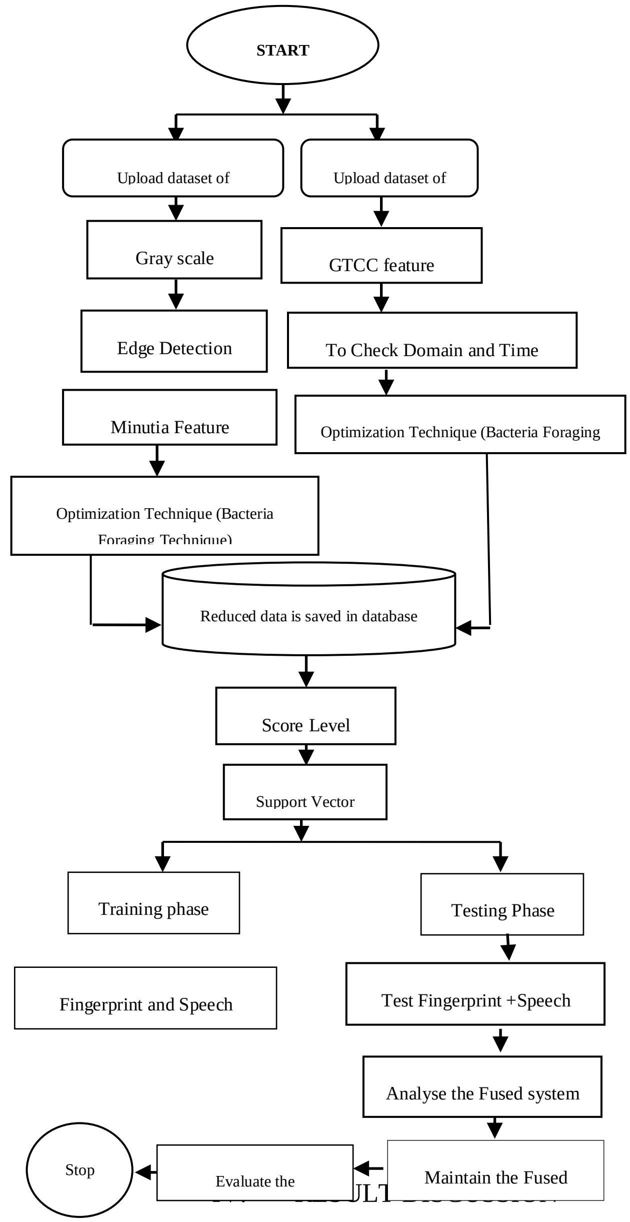

Fig. 5: Proposed Flow chart

In this section we present the experiments and their results along with their discussions. We recognize and classify the expression for the images in the testing dataset and the quality of the same was accessed using the quality metrics discussed below. The test set for this evaluation experiment image randomly selected from the trained dataset as the images to be tested needs to be trained first. Matlab 7.0 software platform is use to perform the experiment. The PC for experiment is equipped with an Intel P4 2.4GHz Personal laptop and 2GB memory as discussed above. The scheme is tested using ordinarily image processing. From the simulation of the experiment results, we can draw to the conclusion that this method is robust to many kinds of FER systems. The Quality metrics are a measure of performance of the methods used. Image quality is a characteristic of an image that measures the perceived image degradation as matched to an ideal image. The quality metrics are used in this report to describe the quality of the image.

Table 1 Proposed Parameter

S no.	Parameter	Result value
1	Mean square error rate	25.2278
2	False acceptance rate	0.010861
3	False rejection rate	0.012608
4	Accuracy	97.6531
5	Recall	0.98739
6	Precision	98.9139

The above table defined that the performance parameters like far value is 0.0108815, frr value is 0.01260 and Accuracy value is 97.6501. The above figure defined that the performance of the Mse value is 25.2278, precision value is 98.9139 and recall value is 0.98739.

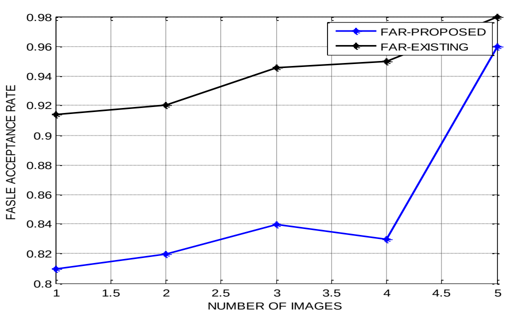

Fig. 6: False Acceptance rate

The figure shows; comparison of the false acceptance rate means positive data find using classification in the testing Module and Extract the unique Features. The false acceptance rate identifies the value is the proposed acceptable error is 0.01889 and existing acceptance error is 0.98. The False Acceptance rate (FAR) is the probability that the system incorrectly authorizes a non-authorized person, due to incorrectly matching the biometric input with a template.

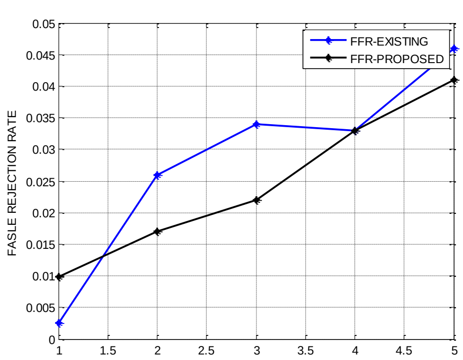

Fig. 7: False Rejection rate

Figure shows, comparison of the false rejection rate (FAR) means negative data collect using SVM for classification and feature identifies the scale invariant feature transform. The false rejection rate (FAR) compute the proposed value is 0.0081 and existing value is 0.0046.

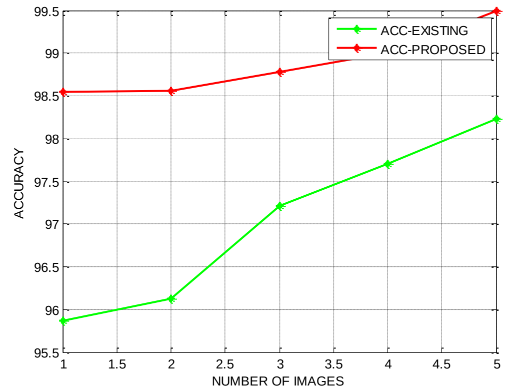

Fig. 8: Accuracy

This figure defines; to comparison between proposed and existing the accuracy throughout the whole system. This is define the system has exact working. We identified the accuracy proposed value is 99% and existing value is 98.2%.

V. CONCLUSION AND FUTURE SCOPE

This thesis has proposed verification system based on Fingerprint and speech. In the proposed system a new technique is generated at score level fusion to increase the performance of the Finger print and speech authentication system. In this firstly multimodal system is developed using Munities and GTCC only. After that FAR, FRR and accuracy has been evaluated in which Munities feature extract with BFO performs good having results like For BFO-GTCC-NN Accuracy = 97 %, FAR= 0.01831, FRR= 0.00815. From the graphs it has been concluded that Munities and MFCC technique works well. The future work, it can implement the firefly optimization algorithm is more powerful for the problems with several amounts of variables given. Firefly optimization is very well organized in discovering the whole search space or any of the solution space, which is very large and difficult. The Firefly optimization algorithm is executed using computer simulation, hiring residents of individuals, which is the solution space. The individuals undergo the selection process by evaluating the fitness function, using several functions.

VI. REFERENCES

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