ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

Unique Identification of Identical Twins Using Multimodal Matching

B.Lakshmi Priya[1], Dr. M.Pushpa Rani[2]

Ph.D Scholar, Dept. of Computer Science, Mother Teresa Women's University, TamilNadu, India[1]

Professor & Head, Dept. of Computer Science, Mother Teresa Women's University, TamilNadu, India[2]

ABSTRACT: Nowadays most systems that control access to financial transactions, computer networks, or secured locations identifying authorized persons by recognizing passwords or personal identification numbers. The weakness of these systems is that unauthorized persons can discover others passwords and numbers quite easily and use them without detection. Biometric identification systems, which use physical features to check a person's identity, ensure much greater security than password and number systems. Biometric features such as the face or a fingerprint can be stored on a microchip in a credit card. If someone steals the card and tries to use it, the impostors biometric features will not match the features stored in the card, and the system will prevent the transaction. In a single feature, sometimes fails to be exact enough for identification. For example consider identical twins. They have the same face structure and share same DNA sequence. Therefore, it is difficult to identify identical twins on the basis of their DNA sequences also. Their faces alone may not distinguish them. Another disadvantage of using only one feature is that the chosen feature is not always readable. For example, some five percent of people have fingerprints that cannot be recorded because they are obscured by a cut or a scar or are too fine to show up well in images. Therefore, in this researchers have introduced a new approach for identifying identical twins on the basis of a multimodal identification system that uses three different features face, fingerprint and Mouth print to identify people. With its three modalities, achieves much greater accuracy than single-feature systems. The Experimental results prove to the best Performance among all the unimodal and multimodal biometric systems, achieving an almost perfect separation between genuine and impostor distributions of identical twins.

KEYWORDS: Face; Fingerprint; Identical Twins; Mouth Print; Multimodal Features

I. INTRODUCTION

Biometric comes from the Greek language and is derived from words bio (life) and metric (measure). A biometric system is basically a pattern recognition system automated methods of recognizing a person based on physiological or behavioural characteristics of a person. Physiological Characteristics related to human shape of body like face, iris, retina, finger prints, hand geometry and palm print. Behavioural Characteristics related to behavioural of the person like voice, signature and keystroke dynamics. Some more promising biometric strategies are hand veins, facial thermo gram, DNA, odor /scent. Biometric technologies are a secure means of authentication because biometric data of every person is unique and cannot be shared cannot be copied and can't be lost. Biometrics, which refers to automatic identification of people based on their physical or behavioural characteristics, is constitutionally more reliable than traditional knowledge-based (password) or token-based (access card) methods of identification. But, the face recognition system degrades of the recognized Identical twins because biometric signatures they are have very similar, especially when the signature is derived from a face image. While face recognition software system exhibited inadequate performance, there are other biometric modalities that can offer a performance increase at the cost of increased invasiveness. Distinguishing identical twins based on facial appearance is one of the most challenging problems in facial recognition due to the similarity in their facial appearance and hence telling them apart using facial features is not a trivial task. There are two types of twins: monozygotic (or identical) and dizygotic (or non-identical). Monozygotic twins are a result of a single fertilized egg that splits into two cells, each one giving origin to one individual. Dizygotic twins are a result of two different fertilized eggs. Monozygotic twins have the same deoxyribonucleic acid (DNA) and, therefore, they cannot be distinguished using DNA [1]. Thus, it is necessary to use other forms of identification for monozygotic twins. Recognition using biometric traits is now a well accepted and proven method. A biometric characteristic is a detectable biological or behavioral characteristic of an individual that is

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

distinguishable and repeatable. Some examples include fingerprints, face, palmprints, iris, retina, and voice. A biometric system relies on the distinctiveness of the biometric characteristics to perform the recognition. While many biometric techniques are extremely accurate, some variations in sensing data, noise, etc. can cause the system performance to drop significantly. We could say it is more difficult to discriminate identical twins than unrelated persons because of their genetic similarity. Although identical twins cannot be distinguished from each other using DNA, some of the biometric modalities, such as fingerprints, iris, and palmprints, can still be used to distinguish them [2]. Some experiments show that face and voice [3], [4] can be used to distinguish identical twins. Due to the difficulty in obtaining a large biometric database of identical twins, most experiments are performed on small databases, making the conclusions less reliable.

The rest of this paper explores the impact of identical twins on unimodal and multimodal biometric systems. In Section 2, present previous studies based on biometric twin data. In Section 3, present the biology of the three biometric characteristics that will be used in our multibiometric experiments, namely fingerprint, face, and Mouth print. In Section 4, Experimental results on matching individual biometric traits as well as various combinations of modalities. In Section 5, concludes the paper.

II. RELATED WORK

In order to design a robust and efficient biometric system, the system must be able to handle a variety of situations like noisy data, limitations of the sensors, environmental conditions, and the presence of identical twins. There are a great number of twins database images were collected from different twin's festivals in Twinsburg from World Wide Web [5]. They mostly vary in size, purposes and the conditions in which the images were taken. Fig.1 List out the some sample images of twin face Database. A crispy description of those recent significant researches is presented below:

Jain Anil et al. [6] this paper give an introduction to biometric system which is basically a pattern recognition system. Introduction to multi-biometric systems, their classification and various integration strategies and presented. Multi-biometric system employs more than one biometric trait and hence provides greater level of security as compared to uni-modal biometric system. Its patterns are complex and have degree of randomness in them.

Sun et al. [7] this paper presented a study of distinctiveness of biometric characteristics in identical twins using fingerprint, face and iris biometrics. They observed that though iris and fingerprints show little to no degradation in performance when dealing with identical twins, face matches experienced problems is distinguishing between identical twins.

Jain Arun et al. [8] this paper presented various issues related to multimodal biometric system have been presented. By combining multiple biometric traits, the performance of biometric system can be improved various applications of multimodal biometric system and different levels of fusion are discussed.

Ariyaeeinia *et al.[9]* performed recognition experiments using speech data from 49 pairs of identical twins. The authors performed basically two different experiments: a general experiment, in which any two persons in the dataset were considered impostors, and the twin experiment, in which the impostor tests consisted of the tests between a person and his/her twin. The Equal Error Rate reported was 1.0% for the twin experiment using short test data (each person saying his/her date of birth), and 0.5% for the general configuration. Other authors have tried to distinguish identical twins based on voice in a multilingual environment[10].Using a database of 12 twins, Patil and Basu reported the highest success rate as being 100% for a particular size (in seconds) of the training speech, and particular size (in seconds) of the test speech. They also observed that the majority of errors were due to matching the actual speaker with his/her twin brother/sister.

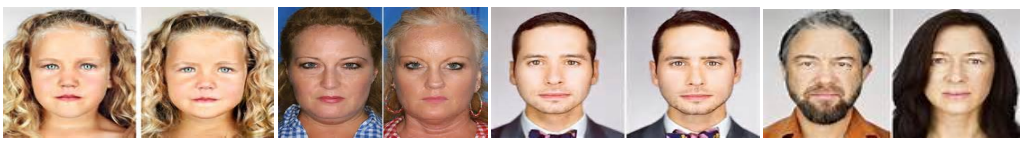

Fig. 1 Sample images of twin face Database

III. METHODOLOGY

The block diagram of the Proposed Multimodal Authentication System is shown in Figure 2. After Suitable a Multimodal System uses multiple Sources of biometric information in order to recognize an individual. In the next

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

subsections, these researchers focus attention on the distinctiveness of fingerprint, face and mouth print for identical twins. The three modalities will be used in this research Multi biometric trait of identical twins.

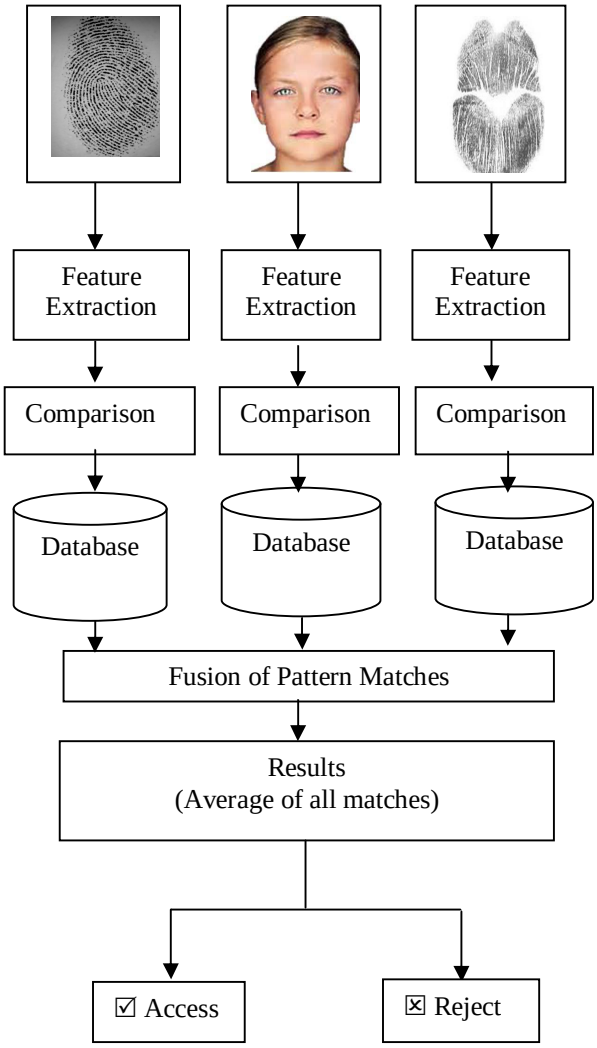

Fig.2 Proposed Multimodal Authentication System

A. *Finger Print Recognition*

A Finger Print is a feature pattern of one finger. Each person finger prints are unique and permanent. It consists of ridges and furrows or valleys. The dark area of fingerprint is ridges and white area is valleys. Because of low cost, accuracy, uniqueness made fingerprint recognition most popular. Finger print recognition can be done using minutiae based, ridge based, correlation based and gradient based. In this paper, minutiae based method is presented. Minutiae points are local ridge characteristics that occur either at a ridge ending or a ridge bifurcation [11, 12, and 13]. Fig 3 and Fig 4 shows finger print image and different minutiae Types.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

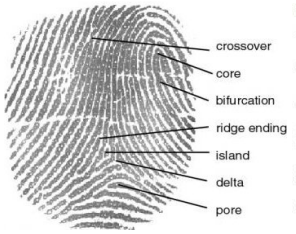

Fig. 3 Finger Print

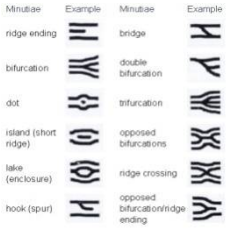

Fig 4. Minutiae Types

1) Finger print Feature Extraction

Minutiae segmentation is needed to achieve high quality. Segmentation algorithm separates foreground from noisy back ground. Image enhancement algorithm keeps the ridge flow pattern without altering minutiae points and not including false information. This helps in extracting minutiae points efficiently. Crossing Number (CN) is widely used in minutiae extraction. CN of a pixel is given by

$$C_n(P)=(1/2)\sum^{8}_{i=1}|P_i-P_{i+1}|$$

Where Pi is a binary pixel value in the neighbor hood of P with PI=0 or 1 and P1=P9. The Cn(P)=1 as ridge ending and Cn(p)=3 correspond to bifurcation. The features extracted from the input finger are compared with those in template. The result of such process is called degree of similarity or matching score. The problem in matching is due to different impressions of the same finger. This variability is caused due to rotation in different acquisitions, partial overlap, and skin conditions. In fingerprint matching, one minutiae from each finger print image is chosen and the similarity of two ridges associated with two minutiae points is calculated. If the similarity measured is larger than threshold, transform each set of minutiae to new coordinate system and its origin is from reference point and x-axis is coincident with direction of reference point Shows in Fig 5.

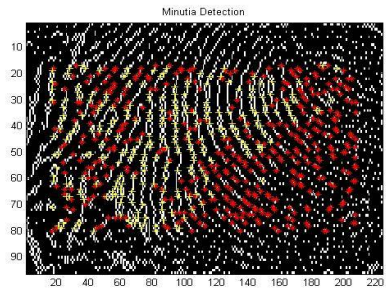

Fig. 5 Minutiae Points

B. Face Recognition

The Face recognition system is critical when individuals have very similar biometric signature such as identical twins. In this paper bias variance method is used to solve face recognition problems. This method is based on analysis of confidence interval. The variance projection function is developed and employed to locate landmark on human face which are then used to guide the detection of position of different points on face. For example, an algorithm may analyze the relative position, size or shape of eyes, nose, cheekbones and jaw. Show in Fig. 6. In Bias variance method smoothing interval of each image is calculated, then estimated value of each interval is calculated to determine confidence interval, variance is defined for each pixel, after that filtering is done for smoothing of image. Smoothing factor and variance are the main feature vectors for face extraction.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

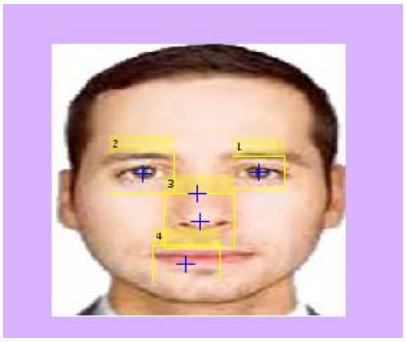

Fig. 6 Measuring the each facial Components

1) Facial Feature Extraction

In this Paper, we present a probabilistic similarity measure based on the bias algorithm between two facial images intensity differences, denoted by $\Delta=I_1-I_2$, are characteristic of typical variations in appearance of an individual. In particular, we define two classes of facial image variations they are intra personal variations (Ω_I) and extra personal variations (Ω_E). Bias rule, using estimates of the likelihoods $P(\Delta|\Omega_I)$ and $P(\Delta|\Omega_E)$. These likelihoods are derived from training data using an efficient subspace method for density estimation of high dimensional data. Show in Fig.7 Apply for bias extraction.

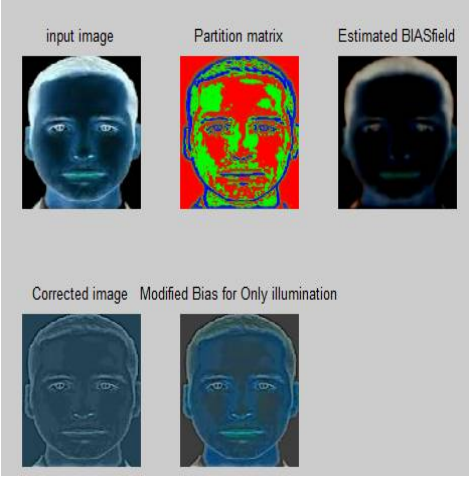

Fig.7 Bias Extraction

The features extracted from the input face are compared with those in template. The result of such process is called degree of similarity or matching score. The problem in matching is due to different impressions of the identical twins. In entire face incorporates information regarding the spatial relation among the facial component separately how far the one component to another distance matching is calculated.

C. Mouth Print Recognition

The Mouth print recognition approach towards identification of human beings from the statistical analysis of their lip prints. Lip based identification approaches might not give results comparable with face of fingerprint verification techniques, yet these emerging modalities must be explored to increase efficiency in hybrid identification systems where more than one modality can be used to improve efficiency. Mouth prints can also be a basis for crime detection. It is used to find the situation on the basis of evidence surrounding the crime spot for identifying number of people involved, their nature, sex as well as type of crime committed during the event. Currently, there are no electronic devices designed for acquisition of lip print images. The acquisition takes place by a traditional method with the use of a specialist fingerprinting roller and magnetic powder. Example of Mouth print image show in fig.7

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

Fig.7 Mouth Print Image

1) Mouth Print Feature Extraction

In the feature extraction algorithm is carried out for both the upper and lower lip. This process relies on determination of the lip images which corresponds to the lip section of image face has dimension of 70X32 Pixels. Then the colour images are converted into gray scale and processed using histogram equalization. Show in Fig.8 mouth print congruency. The features extracted from the input face are compared with those in template. The result of such process is called degree of similarity or matching score.

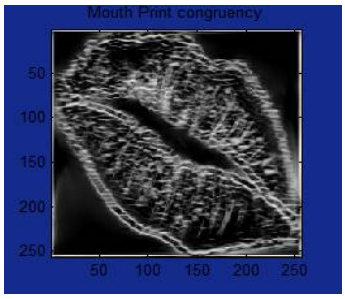

Fig. 8 Mouth Print Congruency

IV. EXPERIMENTAL RESULTS

In this section, the proposed system results have been discussed. The performance of the proposed multimodal biometric recognition is tested on a twin's database consisting of 436 pair of identical twins from whom the fingerprint, face and mouth print images of the persons are collected. The images are acquired in a resolution of 256x256 sizes. We have implemented our multi modal biometric system in MATLAB R2013a on an Intel Core i3 Windows 2008 workstation. To build our virtual multimodal database, these researchers have chosen 429 pair images. Twins Face images are randomly sampled as training samples, and the remaining are left as test samples. The technique is also applied for fingerprint and mouth print databases to collect training samples. Then, each sample of the face database is randomly combined with one sample of the fingerprint and mouth print database. The performance of a biometric system can be shown as a Receiver Operating Characteristic (ROC) curve that plots the Genuine Accept Rate against the False Accept Rate (FAR) at different thresholds on the matching score are shown in Table1.

Modality	**Matching Score**
Finger Print	93.62
Face	91.27
Mouth Print	95.20
Combined Features	93.36

Table 1. Matching Score

The results obtained using multimodal biometric systems were analyzed and the area under the ROC curve for each method using Real Time database are it shows the area under the ROC curve (***Az***), Standard Deviation (*S.D*) and 95% Confidence Interval (*CI*) for each classifier. Show in Fig.9 Results show that high performance was obtained by

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

the proposed scheme when compared to other twin's traits Recognition systems using other multimodal biometric systems.

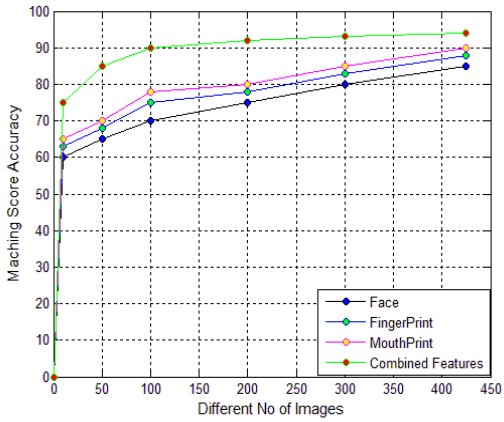

Fig. 9 Receiver Operating Characteristics Curve

V. CONCLUSION AND FUTURE WORK

A Single biometric featured based model is not sufficient for foolproof personal identification. Therefore we need to combine two or more biometric features for fool proof personal identification. A Multimodal biometric identification system resolves the problems of single biometric based identification methods. In this paper a multimodal biometric recognition system based on distinctiveness of identical twins using three biometric traits (Finger Print, Face and Mouth Print) is discussed. The discriminability of these three biometric traits is supported by anatomy and the formation process of the biometric characteristics as discussed in section 3. The unimodal face biometric system can distinguish two different persons who are not identical twins much better than it can distinguish identical twins. We performed the multimodal experiments and showed that the performance of a multibiometric system that uses different units of the same modality is improved compared to unimodal systems, reaching almost perfect accuracy on our database. Based on our experiments on this relatively small twin database, for example we can conclude that the presence of identical twin data poses a real challenge to commercial face recognition systems.

REFERENCES

1. Jain, A. K., Prabhakar, S., and Pankanti, S., "On the similarity of identical twin fingerprints," Pattern Recognition 35, 2653-2663 (2002).
2. Kong, A. W.-K., Zhang, D., and Lu, G., "A study of identical twins' palmprints for personal verification," Pattern Recognition 39, 2149-2156 (2006).
3. Kodate, K., Inaba, R., Watanabe, E., and Kamiya, T., "Facial recognition by a compact parallel optical correlator," Measurement Science and Technology 13, 1756-1766 (2002).
4. Ariyaeeinia, A., Morrison, C., Malegaonkar, A., and Black, S.,"A test of the effectiveness of speaker verification for differentiating between identical twins," Science and Justice 48, 182-186 (2008).
5. "Twins day's festival official website" http://www.twinsdays.org/.
6. Jain Anil.K, Fellow, Ross Arun, Prabhakarsalil (Member IEEE): "A Introduction to Biometric Recognition," IEEE Transactions on circuits and systems for video technology, ISSN: 1051-8215, VOL. 14, pp.:4-20, Issue No. 1, JANUARY 2004.
7. Z. Sun, A. A. Paulino, J. Feng, Z. Chai, T. Tan, A. K. Jain, "A study of multi biometric traits of identical twins, "SPIE, Biometric Technology for Human Identification, Orlando, Florida, VOL.7, pp.: 1–12, April 2010.
8. Jain Arun, Aggarwal sona, "Mult imodal Biometric System: A Survey," International Journal of Applied Science and Advance Technology, ISSN: 0973-7405, VOL. 1, pp.: 58-63, January-June 2012.
9. Ariyaeeinia, A., Morrison, C., Malegaonkar, A., and Black, S., "A test of the effectiveness of speaker verification for differentiating between identical twins," Science and Justice 48, 182-186 (2008).
10. Ivan Gonzalez-Diaz, Member, IEEE, Carlos E. Baz-Hormigos, and Fernando Díaz-de-María, Member, IEEE, "A Generative Model for Concurrent Image Retrieval and ROI Segmentation," IEEE Transactions on Multimedia, ISSN: 1520-9210, Issue No. 1, VOL. 16, pp.: 169-183, January.
11. Roli Bansal, Priti Sehgal, "Minutiae Extraction from fingerprint images-a Review", International journal of computer science issues, vol 8, 2011.
12. Andrew Ackerman, Professor Rafail Ostrovsky, " Fingerprint Recognition" (internet) .
13. Nimitha Chama "Fingerprint Image Enhancement And Minutiae Extraction".(internet).