A Multimodal Biometric User Verification System with Identical Twin using SVM 2

B.Lakshmi priya, M.Pushpa Rani

Abstract: ***A biometric system recognizes unique features of a distinct found on the resolution and examining the behavioral and physical characteristics. Yet, the objective of existing search is to identify and verify the authorized person but it is inefficient due to noisy data, unacceptable false rates and identical twins. However, the identical twin has a high complexity owing to the closest genetic relationship with overall biometric recognition. Multimodal biometric system uses multiple sensors to conquer the detriment of single biometric system. Hence, this method uses Adoptive Median Filter for reducing image distortion and SVM2 classification to improve the false rate which ensure reliable and precise biometric recognition system. This propounds a multimodal biometric user verification system by integrating fingerprint; facial recognition and lip print images which produce a robust, reliable and accurate authentication result.***

Keywords **: *Biometrics, Image Processing, Adoptive Median Filter, Multimodal biometric System, SVM2***

I. INTRODUCTION

Image processing transforms image into digital information to get enhanced and useful information. It is a kind of signal processing which includes importing the image, analyzing, manipulating and reporting an output. Emerging trends in image processing is rapidly growing and biometric based authentication technique which gained a vital role in recent technology.

Biometrics is construe as a measurable and statistical analysis of personalized characteristics. The distinctive biological traits which are known as bio metric identifiers and it contains two types physiological and behavioral. Among physiological techniques which is used to evaluate the physical characteristics of human being like face, finger print, Iris, Hand Geometry, DNA etc., Another one is behavioral techniques - it can evaluate the behavioral characteristics of humans such as gait, keystroke dynamics, voice, signature etc.,

The Biometric modes are two types : One is Identification and another one is Verification. Identification mode which identifies a human evaluating from a mighty data base for an enrolled matches and verification mode verifies a human's similar identity from an enrolled templates. In Biometric identification of a human is quick, easy to handle, accurate, reliable and cost effective. The Biometric traits are used to identify a human distinctive characteristics from other traits. This can eradicates the problem of traditional methods such as username/password systems may affect the security. it can affect and cannot give necessary security in data driven world. The biometric identifier is selected to do particular task for specific application is reliant on different functions like Universality, Uniqueness, Permanence, Collectability, Acceptability Circumvention, Performance etc., Biometric identifier is reliant upon particular application based on purpose which suits to the application according to the comfort and security. still, in most of the case, single biometric identifier is used to cover all the necessity in most of the application. The unimodal system is to verify and identify the individual triat in biometric identification system. it is called single biometric system. The biometric system which is able to identify an individual with two or more combinations of traits using biometric identification system is known as multimodal biometric system. The most important reason behind using multimodal biometric systems is to improve the efficiency and recognition rate. the taken biometric characteristics might be not in required condition because of imperfect input or noisy environment. In facial recognition there are some restrictions are identified in application due to the originality of taken facial images can get spoiled by lighting environment and expressions of face. In case of identical twins, face recognition is may be inaccurate and it is difficult to matching because the camera cannot distinguish twins it makes imperfect in matching. In fingerprint recognition, there are some restriction that is scanner unable to scan the finger print due to the soiled finger prints. An enrolled user possibly can be rejected at the same time an impostor accepted falsely. On elderly persons and young children case the finger print may be improper images due to the age factor faded finger prints for elderly people or underdeveloped fingerprint ridges.

Hence, multimodal biometric systems hybrid two or more methods which follows face, finger print and lip print recognition. The system measures an input from two or more different biometric sensors. The hybridization to evaluate different biometric traits to increase the advantages and reduce the limitations of the individual assessments. compared with unimodal systems, the multimodal system are very hard to spoof. multi modal biometric if one biometric modal spoofed, till the person is able to authenticate other biometric identifiers.

A. Fingerprint biometric concept

It is one of the merely method accepted internationally as permissible to identify a person. Finger print states the automated verification of humans by their finger prints. In finger print biometric concept there are two methods which are pattern and minutiae matching. Minutiae-based matching, which are unique in their nature.

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identification of finger print is based on ridge, bifurcations and spots.Pattern matching compares and checks similarity for the two images for checking similarity.
The arch, loop and whorl are the three patterns which are followed in finger print ridges.

- ***Arch***
  Through ridges an arc is formed, the ridges enters into finger from one side and it rises in the centre, and it exits on the other side of the finger.
- ***Loop***
  In the finger ridges create a curve by entering and exist from same side.
- ***Whorl***
  It is a series of close to concentric circles in the finger.

Fig. 1 Real Fingerprint of different quality by biometric sensor
(Good Quality/Average Quality/Bad Quality)

B. Face Biometric Concept

Face recognition is biometric method is automatically identify and verifying a subject with digital image or video source. recognition is completed by differentiating the captured facial images from the face data base. The Face Recognition system is likely to foretell the location of eyes, nose, lips, mouth, eyebrows and chin distances between these factors and their spatial relationships. However, the identical twin has a high complexity owing to the closest genetic relationship with overall biometric recognition.

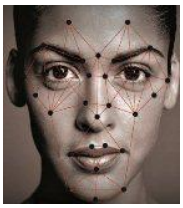

Fig. 2 Face Biometric Sensor

C. Lip print Biometric Concept

This approach won't provide as much as better result when try to compare with finger or face verification methods, these upcoming modalities have to find the ways to increase the accuracy in hybrid identification systems at more than one trait can be used . At present it is mostly used in the field of crime detection according to the environment which posses the evidence around the crime spot to identify the number of people involved, it identifies the nature of the person, gender and also can find what sort of crime has committed during that incident. This lip print recognition researches and data are useful to identify the crime detection. this is much useful and vital to find subject's criminal activities.

Fig. 3 Lip print biometric sensor

II. RELATED WORK

Ashish, Mishra [1] focuses on a need of biometric system in pattern recognition and its functions by acquiring, extracting and compares biometric data from an individual. A multimodal biometric system has more precision than unimodal biometric systems or otherwise analysing the modalities are more complicated. In this paper this researcher describe about various types of multimodal biometric systems and various decision fusion methods used and their possibilities over the unimodal bio metric systems.

Raghavendra.R, et.al [2] proposed a person verification system by multimodal biometric system such as speech and face data. It includes two classifiers uses sum rule after normalization. Multimodal biometric person verification performs more than the unimodal person verification. The facial system intended using 2D Linear Discriminate Analysis compare with speech expert as feature extractor using Linear Prediction Cepstral Coefficients.

Mary Lourde R, et.al[3] enhanced the accurate personal identification system to secure from the malicious attacks. Among all, a fingerprint identification system has the most attention due to the vast usage of forensics. This paper having challenging to find an optimal algorithm to match the fingerprint to form a design that needed descriptions in accuracy and performance. By using MATLAB simulation two different competing algorithms are experimented in large data base.

Chun-meiWANG,et.al[4] illustrates to denoise the image use median filter algorithm. In variable sized - windows there are two thresholds are used to detect the noises. the mean and median filter are combined to varying the values of abnormal pixels. while using impulsive type noise filter that preserves the fine details during suppression of the image. Adaptive Median Filter performs efficient than traditional filter system.

S.Anitha, et.al[5] generates and analysis the texture content in digital images in the automated inspection of fabric images to find out the errors. The initial stage retains the important information from error detection. To find out the noise pixel from noise free pixel using the switching median filter and use genetic algorithm to remove noise by threshold estimation. Measurements are used to calculate the high signal to noise ratio, edge protecting capacity, structure protecting capacity and time complexity.

P.Kapsalas, et.a1[6] take a countable number of persons to guide and find the performance. The fundamental idea is the object location can be decided by collecting points of interest and grading the person region due to sameness and spatial nearness.

M. A. Jayaram,et.al[7] improved a recognize persons using ear biometrics on supervised learning using Support Vector Machine (SVM). Here the researcher discuss that ear has a planar surface of irregular shape. The attributes are distribution of area, moment of inertia (MI) with respect to lower and higher axis.

A database of 605 ears has been taken in the model. The SVM method is strong and feasible result oriented approach.

R. Kathirvel, et.al [8] focused the scarcity problem of satellite image by multispectral sensing method. The SVM-2 (Support Vector Machine – 2) used to classify the different types of land covering area. Using segmentation and semi supervised learning algorithm similarities are controlled in the multi spectral image. The segmentation technique is to make big image into meaningful and make comfortable to analyze. The semi supervised algorithm and multi spectral algorithms are gives high resolution and good quality data to the satellite sensor applications improves a dependable recognition **.**

Anil K. Jain,et.al[9] improve a reliable recognition to either confirm or identity of an individual requesting their services. The purpose is to make sure the provided operations by a correct user. By using biometrics, begin an individual's identity based on username/passwords.

HuiXu, et.al[10] focuses smartphones biometric authentication. It overcomes the issues of security and privacy threats. To conclude this problem, a continues and passive authentication method user's touch activity in the touch screen. this type of operation is suited for android and other smart phones, as it need not any other extra hardware. this operation result is reliable and strong.

III. PROPOSED METHODOLOGIES

The proposed methodologies construe the user authentication by using multimodal biometric system to produce an accurate result. The overall process of the proposed system has been shown in Fig.4. In this construction, the biometric images are obtained from image acquisition database such as fingerprint, facial and lip biometric images.

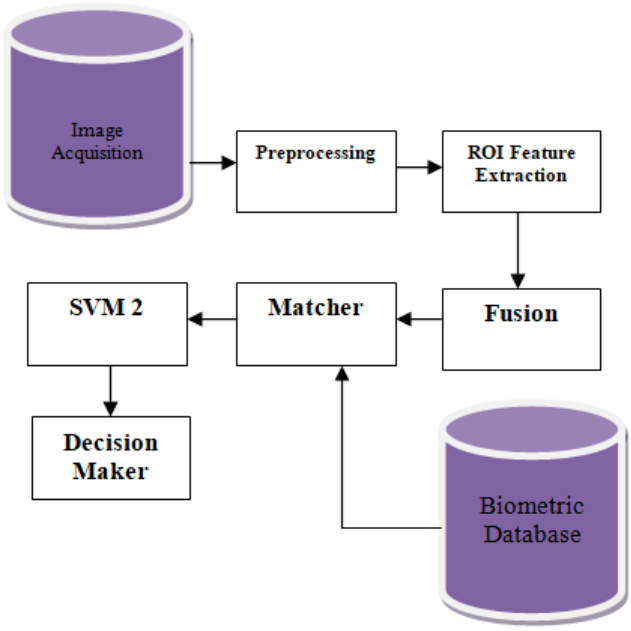

Fig. 4 Overall Process of Proposed System

A. Preprocessing

The task of preprocessing is to noise removal from a signal, cleaning and smoothening the image. In multimodal biometric, adaptive median filtering is to reject impulse noise and also reduces distortion. using this adaptive median filtering operates spatial processing to identify the affected impulse noise from a captured biometric image.

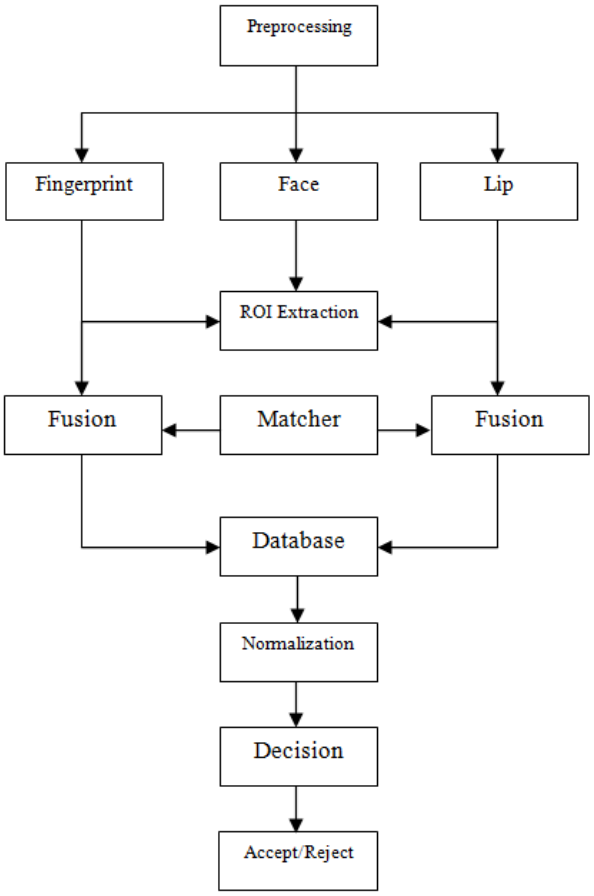

Fig. 5 Process Flow Diagram

During the operation, the changes size of Axy using Adaptive Median Filter and the notations are,
Xmini = minimum gray level value in Axy
Xmedi = median of gray levels in Axy
Xmaxi = maximum gray level value in Axy
Amaxi = maximum allowed size of Axy
Xxy = gray level at coordinates (x, y)
Phase A:
ifXmini<Xmedi<Xmaxi then
• Xmedi is not an impulse
go to Phase B to test if Xxy is an impulse
else
• Xmedi is an impulse then the size is increased
Phase A is repeated until
Xmedi is not an impulse and go to Phase B or
Amax reached: output is Xxy
Phase B:
if Xmini<Xxy<Xmaxi then
• Xxy is not an impulse
output is Xxy (malformation decreased)
else
• eitherXxy = Xmini or Xxy = Xmaxi
output is Xmedi
• Xmedi is not an impulse (from Phase A)

An impulse noise is detected from the biometric image obtained from various sensor differs from a majority of neighbors with unstructured alignment pixels**.** the impulse noise is the captured image is not structurally aligned with same kind of pixels which varied from a majority of its neighbors. To pass the labeling test, the impulse noise pixels are to be relocated by median pixel value. The denoised image is given as input to ROI feature extraction.

B. ROI Feature Extraction

After preprocessing, combines all the three biometric vectors to range a composite trait vector. It transforms the input image into the set of features. The Region of Interest (ROI) in multimodal biometric system extracts regional features to enhance the quality of biometric images. It initially analyzes the important points to decide the places close to the biometric area. Such points are collected according to the equality and spatial feasibility condition. It represent pattern detection, recognition and selects useful information to the corresponding biometric image.

C. Fusion

It integrates fingerprint, face and lip biometric traits coming from various sensors to form a composite biometric trait. the following issues are mentioned below in fusion: they are universality, strength, accuracy, efficiency, reliability and applicability**.** this model is framed to bring the mechanism that combines and classifies the result from each channel**.**

D. Matcher

After matching score has been generated the level of matching score fusion has lesser complication which compares the result from the biometric data base then the resulted matching score is provided on the basis of accuracy of each biometric channel. In the decision process composite matching score is used to find the matching level fusion. It identifies the different level fusions that give more precise when the characteristics of dissimilar biometric traits are conflict with each other.

E. SVM-2

Support Vector Machine is based on statistical learning theory applicable for regression and classification. SVM 2 is used to classify the biometric images obtained from various sensor based on their types and its properties.

- ***Finding the Closest Biometric Pair***

This researchers finding the nearest pair of biometric co-ordinates in kernel space needs n2 kernel calculations where n2 shows the total number of data co ordinates. In this proposed method this researcher use a distance preserving kernel closest neighbors in the characteristics space are the same as the closest neighbors in the kernel space. this researcher need not to analysis any high values kernel estimate for the beginning step.

- ***Including the Support Vector Set***

Provide a set S which have only Support Vectors, this researcher to include another Support Vector P to S. in b_i the change will occur due to inclusion of a new point P as.

$$\Delta b_i = W_{mp}\Delta\alpha_p + \sum_{n\in S} Wmn\Delta\alpha n + z_i\Delta \text{dand}$$
$$0 = z_p\Delta\alpha_p + \sum_{m\in S} Zn\Delta\alpha_n$$

where $\Delta\alpha$mis the change in the value of α_m and Δd is the change in the value of d. this researcher initiate off with $\alpha p = 0$ and upgrade αp.

F. Normalization

The candidate matching score is calculated according to the accuracy of every biometric channel, and then combine the matching level to determine a complex matching score which will be used for grading. This researcher can use different techniques to achieve normalization of the match scores.

G. Decision Maker

The persons biometric modalities is early captured and then characteristics are taken. The last stage categorization is acquired by merging the outputs of dissimilar modalities. The biometric traits are further categorized and detect either to accept or reject the person according to the normalization score and the matching database. It verifies the authentication person or not based on the result of above process. Multimodal biometrics can decrease data malformation. In this subjects where the standard of a biometric sample is unsatisfactory, the other biometric modality can be used. For example, if a facial images are rejected the face image due to poor quality using another biometric modality such as finger print rejection will lower the false rejection rates. Here, every biometric trait is initially pre-classified separately and then final categorization is based on the fusion of outputs of the different traits.

IV. RESULTS AND DISCUSSIONS

For authentication performance there are two metrics used they are accuracy and error rate.

Performance depend upon various different factors can be used to distinguish biometrics and the concepts of false acceptance rate (FAR), false rejection rate (FRR), equal error rate (EER).

A. False Acceptance Rate (FAR)

A biometric machine where it accepts the unauthorized person as a authenticated person. it becomes the percentage of wrongly accepted unauthorized user**.**

B. False Rejection Rate (FRR)

By a biometric machine where an authorized person is rejected it means the percentage of wrongly rejected authorized user.

C. Average Error Rate (AER)

FAR and FRR are the purpose of a threshold that can control the grant between two error rates. The threshold is measured to reach the Equal Error Rate (EER) or Average Error Rate (AER).

Table 1.FAR, FRR and AER for different biometric trait

Modality	Sample Size	FAR	FRR	AER
Fingerprint	7	2.691	0.735	1.71
Face	15	3.983	0.869	2.43
Lips	20	4.375	1.971	3.17

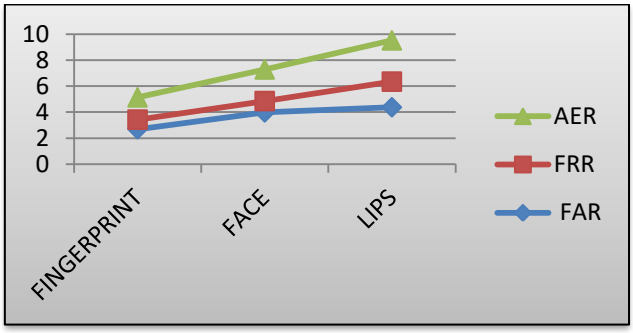

Fig.6. FAR, FRR and AER for Different Biometric Modalities

The AER is defined as:

$$AER = \frac{FAR+FRR}{2} \times 100\%$$

The algorithm was tested on database comprising of 20 samples from all biometric traits. The samples of every individual biometric trait were used for testing. FAR and FRR are the purpose of a threshold that can control the grant between two error rates. The threshold is measured to reach the Equal Error Rate (EER) or Average Error Rate (AER). Table 1. Shows the biometric authentication for different sample size produce the value of FAR, FRR and AER.

V. CONCLUSION

Biometric authentication of an individual through their own characteristics is the most common way to identify a person. In this paper, a multimodal biometric user verification system with identical twin shows the fingerprint, face and lip classification model using SVM2 with kernel functions is efficient and promising.

It would be seen from the results shown in Table 1that the FRR is less than that of FAR. In Future, hope to test for a large database with considerable distinctiveness in the environment and source of the fingerprint, face and lip prints.

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