A Survey of The Multi Model Biometric Fused System Used For Authentication Process And Techniques

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Abstract **–**The biometric systems are considering human body characteristics and using them for security. It is depending on individual and various biometric models used for security, uni-modal and multi – model biometric systems could be designed. Human multi-model biometric like iris and fingerprints have selective features design and this could be used for verifying the person. In this paper, we surveyed multi-model biometric system based on iris, speech and thumb and fingerprint recognition. Unique feature extraction using wavelets is done. Iris, fingerprint and speech recognition features are extracted in multi-level de-composition of considered image using the family of wavelet called crossbreed wavelet. In this literature survey studied various classifiers used for multi model biometric recognition. Vector feature of the Iris and fingerprint recognition are considered using decision and score level fusion method. Biometric authentication defines that the alternative to conventional authentication systems. It provides the robust process for user verification. Finally, the prototype multi-model biometric authentication will be outlined. Software rules have been verified against normal and widely used databases.

Keywords- Multimodal system, Biometric system, Fingerprint recognition, Iris recognition and feature vectors.

I. INTRODUCTION

The biometric system is becoming internal part of human society with huge requirement of security at different-2 levels. The development in biometric area of security at various levels. The development in biometric area novel kinds of sensors is being available, creating it possible to research closest horizons in the domain of biometric authentication. An authentication of the biometric is based on reliable considering part of the human body features and identifying human from that. The human body area defined is called biometric model or trait in different biometric models which are normally used are fingerprinted, iris, hand, vein, signature and speech etc. These biometric traits could be divide in twice in the main categories [1].

A. Physiological method: it is verified with the state and shape of the human body. Illustrations incorporate, yet aren't constrained to fingerprint, face, palm print, hand geometry and human iris and ear etc.

B. Behavioral method: They are related to the behavior of a human man. Examples add, but aren't constrained to key-stroke dynamics,voice, handwritten and gaint signatures.

A biometric system deals with inherent physical orbehavioral characteristics in each individual to determinetheir identity. Biometric recognition has a wide variety ofsecurity-related applications like access control, time and attendancemanagement system, government and law enforcement,passport-free automated border-crossings, national IDsystems, anti-terrorism, computer login, cell phones andother wireless-device based authentication [2]. Human identificationusing biometrics has attracted the attention of manyresearchers since it is very demanding and also getting nearperfect accuracy is crucial especially for security relatedapplications.

Uni-modal biometric systems may not achieve the requiredlevel of performance and reliability in particular applications. Problems like noise in recorded data, non-universality, intra-class variations, inter-class similarities and spoof attacks will affect the effectiveness and functionality of unimodal biometric systems. Some of these limitations can be overcome using multi-modal biometric systems since they benefit from multiple sources of information [3].

Multi-modal biometric systems combine measurements from different biometric traits to enhance the strengths and mitigate the weaknesses of the individual measurements. In a multi-modal biometric system, information fusion can occur in various levels:

- Sensor level
- Feature level and
- Matching
- Score level and
- Decision level [4].

Multi biometric systems combine various biometric data at different levels like sensor level, feature extraction level, score level or decision level. The fusion at score level is widely used in biometrics as it is simple and efficient. It is based on the combination of similarity scores of the biometric matchers.In case of score level fusion , score obtained from individual matchers arefused together to form single score which is further passed todecision module. Decision level fusion aims

at taking decisionfor subject as a genuine or imposter by combining decision ofall different traits of subject.

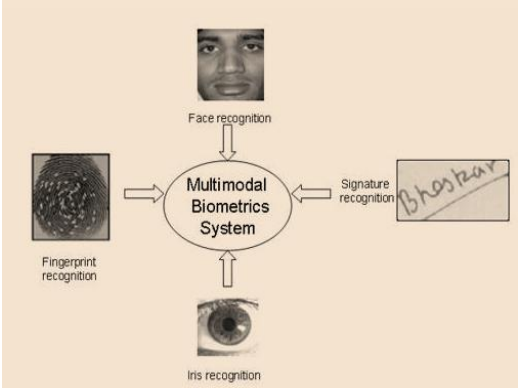

Fig 1. Multimodal Biomtric Systems [5]

The main problem with statistical and learning fusion techniquesappears when different uni-modal biometric systems produce highly conflicting results. These methods are not able to handle this conflict and the fusion performance is not enhanced. In opposition, belief functions can manage the conflict between many uni-modal biometric systems.But, these techniques are focused on using transformationmethods like weighted sum rule, product, exponential sum and hyperbolic sum. Other fusion approaches such as learning and belief functions methods have not been used with evolutionary methods. In order to improve the verification performance of several biometric systems, a framework for multi-biometric fusion is proposed. It combines belief functions with evolutionary methods[6].

II. RELATED WORK

Lamis Ghoualmi (et al.),2015 [7] 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[8]** 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 tunable 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 method to achieve higher level of accuracy. **Samarth Bharadwaj (et.al), 2014 [9]** Review of the features, strengths, and boundaries of existing quality evaluation technique in fingerprint, iris, and face biometric are also obtainable. lastly, a courier set of quality metrics from these three modalities are evaluate on a multimodal database consisting of 2D 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 [10]** In this section fingerprint and iris based unimodal and multimodal confirmation systems will be describe, analyses and evaluate. To conclude, a proto typed embedded multimodal biometric sensor will be sketch. Software [10] and hardware prototypes have been checked against common and broadly used databases. **Sambit Bakshi et al., 2012 [11]** 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 a mathematical monotonic function on these two 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. UNIMODEL/MULTI MODEL BIOMETRIC SYSTEM

A. Iris Recognition

Iris Recognition System: Iris is the annular region ofthe eye located between pupil and sclera. It has distinctivespatial patterns which makes it unique for each person.Moreover, iris texture is not affected by aging and remainsstable over time. Therefore, iris recognition is a very reliableand non-invasive method for human authentication.

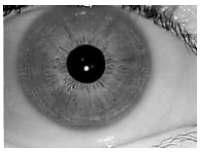

Fig 2. Iris Image [12]

B. Fingerprint Recognition

Human have used fingerprints for personal identification for many centuries and the similar accuracy using fingerprints has been shown to be very high [13]. A fingerprint is the design of ridges and valleys on the surface of a sensitive, the formation of which is determined during the first seven months of fatal advance. Fingerprints of identical twins are different and so are the prints on each finger of the same person.

Fig 3. Finger Print Image

C. *Palm Print Recognition*

The palm is the inner surface of the hand between thewrist and the fingers. Palmprint refers to the various lineson the palm including the principle lines, the wrinkles and the fine ridges. The human palmprint contains richinformation which is unique for each person. This makesthe palmprint a very suitable biometric feature for personrecognition [14].

Fig 4. Palm Print Image

D. *Speech Recognition*

The speech recognition process is performing by a software module known as the speech recognition engine. The most important function of the speech recognition engine is to process spoken input and interpret it into text that applications understand. The application can then do two equipment's[15]:

- The application can understand the result of the recognition as an order. In this case, the applications are a command and manage application. An example of an order and control application is one in which the caller says "check balance", and the application income the current balance of the caller's account.
- If an application handle the recognized text simply as text, then it is measured a transcription application. In a transcription application, if you said "check balance," the purpose would not understand the result, but simply arrival the text "check balance".

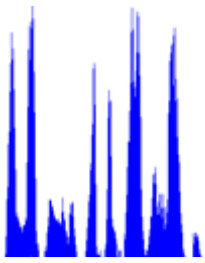

Fig 5. Speech Wave file

IV. PROBLEM IN MULTI-MODEL BIOMETRIC RECOGNITION

The problem is specified as: "Given set number of class speech and finger print biometrics, identify the probe identity by fusing finger print and speech consequences." Most of the previous system compulsory user identity to find the one to one match and consequence is based on the inception value. Unlike the preceding system we proposed recognition based on score level fusion of finger print and low resolution speech signals.

- Multimodal biometrics is the combination of two or more modalities such as fingerprint and speech modalities.
- In this proposed work a Fingerprint recognition system and Speechverification system are combined as these modalities are widely accepted and natural to produce.
- Although this grouping of multi-modal enhances security and accuracy, yet the complexity of the system increases due to increased number of features removed out of the multiple samples and suffers from additional cost in terms of acquisition time[16].

So these days the key problem is at what degree features are to be extracted and how the cost factor can be minimized, as the quantity of features upsurges the variability of the intra-personal samples due to greater lag times in between consecutive acquirements of the illustration also increases.

V. TECHNIQUES AND PROCESS USED IN MULTI-MODEL BIOMETRIC SYSTEM

In this section, we survey the techniques used in multi model biometric system i.e gabor filter, feature extraction and classification.

A. *Canny and HCT approach*

For enhancement and de-noisingwe use histogram equalization to increase the contrast.Afterwards, we detect the center of the eye and removethe light reflections from the pupil area. Then, to localizethe iris, we use Canny edge detection and Hough transformto detect the inner and outer boundaries of the iris. Sincethe inner and outer boundaries are represented by circles,we consider the iris area in polar coordinates and map itto Cartesian space for simplicity of further steps [17]. Irisvalid ROI is then obtained by removing one third of theprojected iris texture from the top.

B. *Region of interest in palm print recognition*

First of all, we use a thresholding techniqueto obtain a binary image. In order to do that we plot thehistogram of the gray values of the image to determine anappropriate threshold value. Then we apply a border tracingalgorithm to get the contours of the hand shape. We next usebinary pixel connectivity to remove all smaller objects which appear due to the noise but are not connected to the hand. Wealso adopt the eight neighborhood directions while trackingthe hand contour to normalize it. Afterwards, we use binaryhole filling algorithm to fill any holes that may exist withinthe hand pixels. After obtaining a binary hand image, we gothrough each column of it and calculate the gradient betweenevery two

consecutive rows in that column. Wherever thegradients become non-zero, we have a binary discontinuitythat corresponds to the edges of the fingers. Having the edgesof the fingers, we compute the gaps between the fingersin each column and figure out the mid points of all thegaps. By proceeding to the next columns and following themid points of the gaps, we fit a second order polynomialto each valley's set of mid points to eventually reach theendpoint of the valleys. The column-wise search finisheswhen we find all four endpoints between the fingers. Thenwe discard the endpoint of the valley between thumb andthe index finger and consider the index-middle and ringsmallfingers endpoints as our two landmarks [18].

C. Munities Algorithm using Fingerprint

The major features of a fingerprintimage are called minutiae. Minutiae points work aslandmarks in a fingerprint using which comparisons of onefingerprint with another can be made. In this survey,we consider the two most important types of minutiaeincluding ridge endings and ridge bifurcations. Each minutiais described by a quintuple containing x and y coordinates, its orientation, and the corresponding ridge segment.First we estimate the orientation field by looking at localneighborhood of the pixels. Considering the fact that ridgesare local maximum gray points of their neighborhood, weconvert the fingerprint image to a binary one by assuminganything that is not ridge is background. Then we use athinning algorithm to minimize the width of ridges. Thisway, minutiae extraction will be much simpler. For eachpixel on a ridge we count the number of ridge pixels inits eight neighbors. If it has only one ridge neighbor, weconsider it as ridge ending and if it has more than two wewill consider it as ridge bifurcation. At this point, we haveobtained a set of minutiae for each fingerprint which can beused for matching them against others[19].

D. Feature Extraction using Gabor Filter

One of the crucial parts of everyrecognition system is to find a set of features that canbest describe the texture and capture the most importantinformation of the image. Gabor filter with its variousorientation bandwidths and multi-resolution reparability, hasbeen found particularly appropriate for texture representationand discrimination. Hence, we utilize modified 2D Gaborfilter to extract the iris features effectively [20].

E. MFCC used for speech recognition

First step in any automatic speech verification system is to extract characteristics that is identify the components of the speech signal that are better for verification the content and removing all the other material which carries sequence like background audio and emotion etc. The major Point to appreciate about speech is that the sounds generated by a human are filtered as a shape of the vocal tract includes teeth and tongue etc. This shape determines what sound comes out. If we can regulate the shape accuracy, this should give us an accuracy representation of the phoneme being shaped.

Mel Frequency Cepstral Coefficients are a feature normally used in automatic speech and speaker verification.

Steps of MFCC: We will a high level introduction to the development steps, then go in depth why we do the belongings we do.

Towards the end we will go more explained described of how to calculate MFCC's[21].

1. Frame the signal into small frames.
2. Each frame calculates the estimate of the power spectrum.
3. Apply the Mel filter bank to the power spectra, average the energy in each filter.
4. Take the Logth of all filter bank energies.
5. Take the Discrete wavelet Transform of the log filter bank.

VI. DESIGN AND MOTIVATION

There are various reasons that lead to the development of the multimodal authentication approaches. These are discussed below:

1. Biometric features values are different at every time.
2. Quality of traits can be changed over time.

There are several limitations that are overcome by the multimodal biometric systems. But the multimodal biometric systems are more expensive than the uni-modal biometric systems. This is the only disadvantage that relies heavy on the multimodal systems. Also if proper fusion does not take place of multiple traits then, it can also leads to worse biometric system[22].

VII. CONCLUSION

This paper presents a novel multi biometrics authentication system, consolidating biometrics information originated from face and signature modalities of a person at feature-level. Biometric types are unique to each discrete and remain unchanged during a person's lifetime. These features make biometrics an auspicious solution to the society. In this paper, a vigorous multimodal biometric recognition system integrating fingerprint and speech is planned. Fusion of two biometric traits is carried out at the match score level. The presentation of planned system is compared with each of the two individual biometrics by plotting ROC curves. These curves show that fusion of multiple biometrics advances the recognition performance as associated with the single biometrics. It also averts spoofing since it would be problematic for an imitator to spoof multiple biometric traits

of a genuine user concurrently. One of the disadvantages is that the database will be very large due to the storage of speech and fingerprint template in memory, therefore extra storage space will be desirable. Increasing user population reporting and reducing enrolment failure are added reasons for combining these multiple traits for recognition.

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