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A Study on Recent Advancements in Bio-Metric Identity Verification

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Abstract: Security plays an important role in day to day life of a human being. Bio-Metric is the study of identification of persons based on his physical or behavioural characteristic. The different methods for verifying identity of a person ranges from finger prints to heart beats. The input taken from the user may be from a single source or multiple sources. In case of multiple sources the combinations may be at different levels. The performance of these methods varies according to the parameters used for a person identification. The study is on the latest new techniques adopted in Biometrics. The focus is on Heart Beat sound, Face recognition invariant to plastic surgery , touch less finger print and keystroke methods.

***Keywords*:** Bio-Metric, Key-stroke, Heart Beat ,Face Recognition.

I. INTRODUCTION

Bio-Metrics is used to authenticate a person using physical or behavioural characteristics. It serves as a measure of identifying a person uniquely based on the characteristics chosen. Bio-Metric could be uni-modal or multi modal. The physical characteristics of a person is nothing but which he owns such as eyes , fingerprint ,ear ,palm etc., The behavioural characteristics can be speech patterns , signature and key stroke of a person. In uni modal Bio-Metrics only one of the above characteristic is considered as input to the system where as in multimodal Bio-Metrics more than one of the above is feed as input to the system. In this study we present the recent new trends in biometric Identity verification. The section II provides the parameters needed for a biometric identity verification system. In section III we address four different new types of authenticating user. In section IV the discussion is on advantages and their application in a real time system.

II. PARAMETERS FOR BIOMETRIC VERIFICATION SYSTEM.

Bio-Metric Identity verification system is described by parameters such as uniqueness ,measurability ,universality ,vulnerability and simplicity [1]. The characteristics of a person used for any biometric system should be ***unique*** such as finger prints are unique even for twins. The devices used for acquiring biometric inputs must be easily ***measurable*** one. The acquired input from a person must be acceptable out the world(***universal).***

The biometrics characteristics of a human being chosen must not be able to reproduce it again. ***(vulnerability)*** . The input for a biometric system must be ***simple*** as to that of a heart sound. In a multi modal system various fusion of biometric identities takes place[2]. The fusion can be at ***feature level, at score level or at decision level.*** The objective of biometrics is to identify a person correctly. In this case the two metrics that are associated are False Acceptance Rate**(FAR)** is to accept an unauthorized user and False Rejection Rate**(FRR)** is denying of access to legitimate user.

III. NEW APPROACHES IN BIOMETRIC IDENTITY VERIFICATION SYSTEM

A. *Heart Sound:*

Wave form of heart sound is captured using phonocardiogram (PCG) device. PCG generates two types of sound signal s1 and s2[2]. And may vary from person to person. S1 sound signal is low and is caused due to contraction of the heart. The second sound s2 is shorter, high pitched generated due to relaxation of ventricle of muscles in the heart. A simple PCG signal is shown in fig 1.1

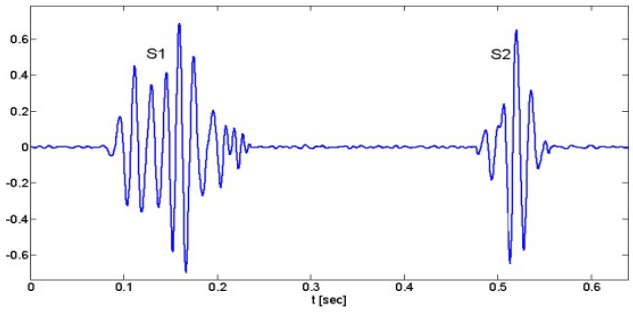

Figure. 1.1 cardiac cycle of Heart.

Heart sound is an acoustic signal similar to a speech recognition system. Feature extraction of acoustic signal is done using Mel Frequency Cepstral Coefficients (MFCC). The extracted feature is used to classify the vectors using Support Vector

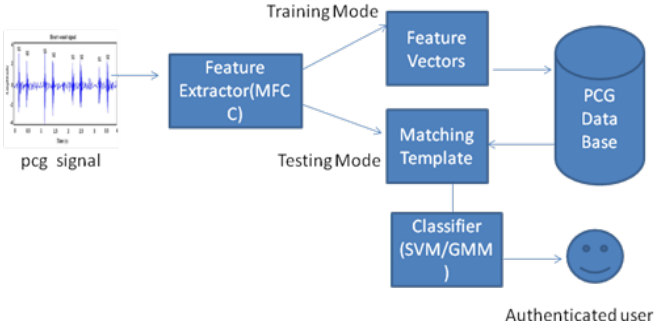

Figure. 1.2 Heart Beat Sound as Bio-Metric

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Machine(SVM).SVM is a pattern classification method used for both linear and non- linear separable patterns of neural networks. As shown in Fig 1.2 input is a cardiac cycle(pcg signal). In the second step pcg signal is converted into feature vector by using feature extractors such as MFCC. The Feature Vectors are stored in to database .During verification of a user the classifier uses SVM to and matching template to authenticate a user.

B. Face Recognition:

Face recognition is also one form of biometric identity verification. The main issue in recognizing face is when a person undergoes any type of surgery related to face. Due to the advancement in technology and interest in beautification many people are undergoing plastic surgery[4]. In such case it is very difficult to identify a person. The details of plastic surgery a person undergoes is confidential, so it is a complex task to identify a person. Plastic surgery is of two types. If the surgery is done for part of a face such as nose , ear , chin etc it is classified as ***"local".*** If the surgery is done to reconstruct the entire face such as facelifts, skin peels then it is called "***global***"[5]. The commonly used face recognition techniques are PLA, FLDA, LFA, CLBP. In these methods we can extract either shape or texture model only. A combination of shape and texture is possible using AAM (Active Appearance Model). Two facial images are used one pre-surgery used for training and the other post-surgery for testing. Landmark point are chosen in the face for shape modelling. Face image is warped to the mean shape by a process called ***"shape free patch".***

C. Shape Local Binary Texture (SLBT):

AAM calculates pixel intensity values where as SLBT retrieves LBF (Local Binary Pattern) feature histogram from shape free pattern. The other source of biometric is extracted from face is eye lids , eye brow and eye surroundings. These regions are called as ***"per ocular "*** . These regions does not change due a person's age. Multi modal biometrics can serve as an alternative for facial recognition instead of uni modal biometrics. The combination of periocular region and face region can lead to an effective way in identifying a person even if he undergoes plastic surgery.

D. Periocular Biometrics:

This type of biometric system does not use any database for a biometric system. These are of three types such as strips , Non-Overlapping and overlapping. In this method four important points are selected in face . "***strip"*** is the area below forehead and the area above nose. "***Non overlapping"*** is the two corner points eye chosen separately. " ***overlapping"*** is the dividing the *strip* in to two regions as left and right. One more additional part that is used in periocular biometrics is "lips" by choosing two corner points.

E. Touchless Finger Print Verification:

In this method the user finger print image is captured from a distance using web cam and a laptop with low resolution[6].The captured image is normalized in the next step using Retinex algorithm. The resultant image in the form of HSV color space and the corresponding 'v' components are extracted. The algorithm first calculates the large distance and then short distance. All the HSV color components are added to the final image. The normalized color components are combined to form a threshold value. Pixels that have the intensity value less than the threshold are assigned white color and the remaining pixels assigned black color. The resulting image is a mask of the original image. In the next step the finger print is extracted from the background and is changed to gray scale based on mean and variance of *Gaussian* filter. To reduce noise in the image *coherence* filter is used. This image is converted to a logical image to retrieve ridges and the method is known as "binarization". The ridges from the images are thinned till they are reduced to one pixel width. The noise ridges (H Breaks) that joins two or more ridges are deleted using a function called "clean". Noisy ridge projections are removed (Spikes) using "Spur" function. The next step is to match the stored templates in the database with the image taken from user as input.

F. KeyStroke Analysis:

Keystroke analysis is one of the behavioral characteristics of human being used for authentication. In this method no extra devices are used for authentication but only analysing how the user types the text using key board. The key stroke latency for each user is different from the other user. The latency of a keystroke is the time taken for the person for adjacent keystrokes , pressure on the keys[7].There two ways for analysing Keystrokes. The first method is of fixed length of strings and the second one is of free text or variable length. The proposed new method [7] is to classify users according to key stroke using Self Organizing Maps (SOM). The types of analysis are ***classification*** in which the user is unknown. In the second type the input is from an unknown user which is ***"identified "*** as a legitimate user or not. In the third method the user is ***"authenticated "*** with the input provided by the user with some details.

G. Self Organizing Maps (SOM):

SOM is a form of unsupervised learning in Neural Networks. It is describes using two layers such as input layer and Kohonen Layer. In the input layer the input and the number of nodes are equal. In the Kohonen Layer there is interaction between nodes. This a form of ***competitive learning*** method in which the neurons nearer to the training vectors wins the competition. The weights are adjusted based on the input neurons and the neighbouring neurons. Using this technique we classify the user stroke analysis by forming as clusters. The chosen cluster and the trained neurons are used to classify the key stroke latency pattern. A string with n characters has a latency time of n-1.SOM are constructed one for each digraph. This digraph represent the input layer of the SOM for one node. In the Kohonen layer neurons are in the form of clusters for each digraph. clusters are selected based on the rank among the members. The best clusters are selected and trained as a neural network. The latency time of the digraph belongs to the cluster then the input value is 1 other wise 0.once the training of the network is completed any unknown user can be identified by the string he or she types.

IV. APPLICATIONS

Neural Networks techniques are widely used in different biometric identification techniques. As the neurons

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are trained and then used for authentication of an individual based on his biometric characteristic, the performance of the system is improved when compared to only biometric methods without artificial neural networks. Heart sound signal as a identity verification of a person has many advantages. It is difficult to have the same heart sound signal because it depends on the age of the person and cannot be used without the persons concern. In case of plastic surgery it was very difficult to identify the person due to the changes in the face. Using the periocular biometrics it is possible for facial recognition even the person undergoes a surgery. This is important in many confidential and security related identifications. In the third studied methods we agree that in some cases touch less finger print access very useful for example in ATM access allowing only one persons so that we can avoid attacks on the users. In the last method using keystrokes to verify identity is useful as such we don't need additional devices .

V. CONCLUSION

This study on new innovative methods in bio-metrics is very useful in identifying the users when compared to the traditional methods. Even though all of the methods are uni modal , by applying artificial neural network methods the performance of the system is enhanced. Further we can extend these techniques by applying more sophisticated neural network algorithms and also by using Fuzzy methods.

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