Biometric Traits and applications of Fingerprint

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Abstract - *Few decades ago, using fingerprints for identification and verification was sign of illiterateness. Now, it's the technology and ultimatums with permanence of fingerprints, which reversed this concept and the same fingerprints are used by all persons including illiterate as well as literate persons. Fingerprints are now authentication, recognition, identity, attendance, key of digital locks and so on, covering different areas like industrial, commercial, civilian, security, financial services, data analysis etc. fingerprint can be used for gender identification which gives about 86% results.*

Key Words: fingerprints, authentication, Biometric, Traits, and Gender.

1. INTRODUCTION

Biometric is the measurement of human body parts and/or behavioural characteristics (also called as biometric traits) with different types of calculations. Biometric traits roughly include face retina and iris [12], fingerprint, palm prints hand texture, ear contour, gait, signature, facial expression and voice. To use the biometric system for identification and/or verification of individuals needs to create database of user using particular methods including different kind of sensors modules, measurement and analysing methods. The identification and verification of different methods used for the various applications may have some problems. For example say PIN or password, or say keys or Identity cards, etc. These methods may have the problem of duplicity, may get lost, may be stolen or it may be guessed very easily. The behavioural biometric characteristics like sign, voice, facial expressions, etc. have main problem of duplicity. The mimicry persons are giving us the similar voice as that of the famous personalities. There are many cases of sign duplicity in various banks and other places. But normally, the body parts of human being may remain fix and unchanged. These likely to be unchanged parts of human body are known as biometrics. The biometrical recognition refers to the use of various behavioural and anatomical characteristics which also known as identifiers like Fingerprints, hand geometry, face, voice, iris, etc.

2. LITERATURE REVIEW

Anil K. Jain et. al. explained the intend and completion of a sample automatic identity-authentication system that uses fingerprints to authenticate the identity of an individual. They have developed an improved minutiae-extraction algorithm that is faster and more accurate than our earlier algorithm. An alignment-based minutiae-matching algorithm has been proposed. This algorithm is competent of verdict the correspondences between input minutiae and the stored pattern without resorting to comprehensive investigate and has the capability to recompense adaptively for the nonlinear deformations and inexact transformations between an input and a template the experimental results reveal that system can achieve a good performance on these data bases. They also have demonstrated that their system satisfies the response-time requirement. A whole verification procedure, on average, takes about 1.4 seconds on a Sun ULTRA 1 workstation [1].

Lin Hing et. al. Developed a prototype biometric system that integrates faces and fingerprints. The system overcomes the limitations of face recognition as well as fingerprint verification systems. The integrated prototype system operates in the recognition mode with the admissible response time. The identity established by the system is very correct. Additionally decision combination scheme enables presentation improvement by integrating multiple cues with different confidence measures. Experimental results shows that their system performs well. It meets the response time and correct requirements. Index Terms—Biometrics, fingerprint matching, minutiae, face recognition [2].

Anil K. Jain et. al. Introduced little overview of the field of biometrics and summed up some compensation, drawback, strengths, limitations, and related privacy concerns. A wide range of systems needs accurate personal identification schemes to confirm or examine the recognition of an individual requesting their services. The aim of such schemes is to ensure, the rendered services are accessed only by a legitimate user and no one other. Examples of such applications involve secure access to buildings, computer systems, laptops, cellular phones, and ATMs. Biometric recognition, or simply biometrics refers to the automatic identification of individuals based on physiological and/or behavioral characteristics. It is achievable to confirm an individual's identity based on "who she is", rather than by "what she possesses" or "what she remembers" with the help of biometrics [3].

Arun Gaikwad et. al. proposed image post processing method. Automatic Fingerprint Identification System is used for personal recognition due to outstanding performance of fingerprints. Minutiae-based fingerprint matching technique is used to match fingerprint. Fingerprint matching results and accuracy rely on

presence of valid minutiae. As per this research work good methods for fingerprint image post-processing, which is used to freeze out a large number of wrong extracted minutiae from skeletonised fingerprint images. They recommended a windowing post-processing method. The neighbourhood of all minutia within the window and check for minutia validation and invalidation. This work presents whole pre-processing structure including new segmentation method. It is required to remove region of interest accurately from a fingerprint image. Experimental results achieved by the proposed approach show efficient reduction of false minutiae [4].

Jang-Hee Yoo et. al. explained an automated system that categorized gender using human gait data. In this research work methods of classification divided in to three stages: a) detection and extraction of the moving human body and its contour from image sequences; b) extraction of human gait signature by the joint angles and body points; and c) motion analysis and feature extraction for classifying gender in the gait patterns. Set of 2D stick figure is used to represent the gait signature that is basic data for the article generation formed on motion parameters. SVM classifier is utilize to classified gender in the gait patterns. In this research, higher gender categorization presentation is done [5].

D. Gnanna Rajesh et. al. proposed efficient algorithm to recognize the gender. Gender classification is the prominent task in the field of forensic anthropology that reduces the list of doubtful search. The current systems uses the parts of body like use the availability of bones, teeth and other identifiable, having physical features that allow gender and age estimation by conventional methods. The various biometrics traits as face, gait, iris, speech and fingerprints are used to recognize the gender and age. Among them biometrics, fingerprint is most commonly available in any crime scene. In the study, an efficient algorithm to recognize the gender of a given fingerprint into male or female is identified. Un-decimated Wavelet Transform technique is employed to extract the features from the fingerprints by applying ranking. Secondly, Gaussian Mixture Models technique is used as classifier for the process of gender classification [6].

3. COMPARISON OF BIOMETRIC TRAITS:

Any biometric system using biometric traits] can be used to recognize the individuals provided that the traits must satisfy some requirements mentioned below,

- **Universality:** Individuals using trait based biometric system must possess particular trait which is acceptable universally.
- **Uniqueness:** Traits used for biometric system must be sufficiently different than other user and must have unique characteristics.
- **Permanence:** Biometric trait supposed to be fixed irrespective of time lapsed. It should remain

permanent irrespective of changes in time, or related conditions.
- **Collectability:** Biometric traits must be measurable in quantitative manner.
- **Performance:** Biometric traits must be robust, accurate and fast recognizable consistently
- **Acceptability:** Must be acceptable by user of biometric system for frequent use.
- **Circumvention:** Biometric traits must be easy to use and must not got cheated by fraudulent methods
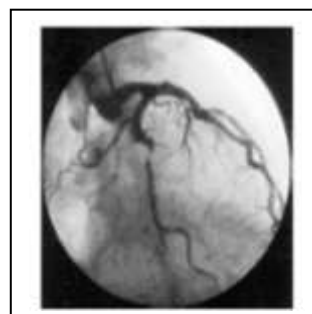
As every biometric trait is considered to be distinct in individuals and used as per requirement of application or requirements, they have its own advantages and disadvantages. The performance of any trait based system depends on fulfilment of above requirement and if any one of the said requirement is failed, it can be big hurdle to the system and system may malfunction which is not overall accepted.

Table 1 Methods and Techniques of Identification and verification technologies with their Related Problems

Method	Problems
PIN, Passwords, identity cards, keys	Forgot, stolen, guessed easily, lost, duplicate
Behavioural biometric characteristics like sign, voice, facial expression	Duplicate
Body parts biometrics	Likely to be fixed

4. DIFFERENT TRAITS WHICH ARE USED FOR BIOMETRICS RECOGNITION

Face: In face based biometric system features of face like nose, facial structure, mouth and lip structure, jaw edges, distance between eyes etc. are analysed and used for confirmation of the same user. The images captured through camera are used as input image and database of system users are stored for matching. For gender recognition, face recognition does not work upto the mark because it can be cheated easily. The makeover and makeup can change some dimensions and also the operations like plastic surgery can change the look.

Ratina: Touch less low intensity light source and optical coupler are used for retinal scan which captures the retinal features like blood vessels of eyes but user need to see with bear eyes and cannot use glasses or contact lenses. The devises used for the retinal

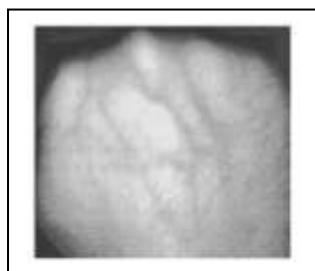scan are rare and may not be available very easily.

Iris: More than 200 points of coloured tissue around the pupil are used in iris based biometric systems in which user can enrol his iris features using iris scan device. Many times this method works even if user wear spectacle on eyes. Though this method is good for user verification but can be fooled by using fake eyes and therefore less suitable for gender recognition.

Hand Geometry: Measurement of user hand is the key for hand geometry technique in which special hardware is needed to enrol user hand shape and measurements of fingers (in some cases pressure also). This system will be cheated by fake hands as there is no any method to detect the liveliness of hand and unlike fingerprint hand shapes or hand geometries are not unique hence cannot be fairly used for user authentication and to predict the gender of user.
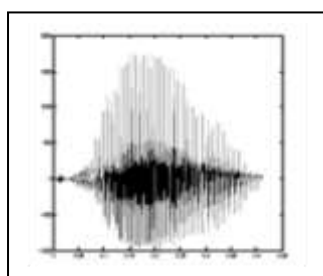

Hand Vein: On the consideration that thickness and location of vein is unique in the humans, the Patterns of vain of hand are captured by using infrared scan which creates image and can be used for user identification.
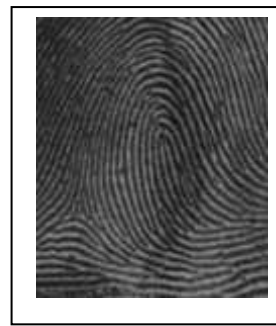

Signature: Signature is the handwritten depiction of individual and varies user to user. Signature verification systems can be online or offline. It does not contain information to predict the gender hence it is not used for gender identification.

Voice: Audio samples are collected and features of audio like tone, frequency and pitch are analysed for identification of user. As this method suffers from background noise and can be fooled by mimicry this method is not widely used for recognition of user and gender recognition.

Fingerprint: In fingerprint based biometric system, fingerprint images are captured by using reader or scanner which captures the fingerprint image and analyse the features. At the stage of verification it performs one to one comparison and for recognition it performs one to many for comparison. As the fingerprints are having high permanence, high uniqueness and high performance, the fingerprint plays a very important role in the identification of gender. Also the Circumvention, collectability, universality and acceptability of fingerprint is very good, therefore the fingerprint biometric is very effective in gender classification applications.

5. APPLICATION AREA OF BIOMETRICS:

There are various applications of biometrics in various fields in our day to day life. For the security and access of ATM, Credit card, Laptops, Mobile phones, Banking applications, etc.
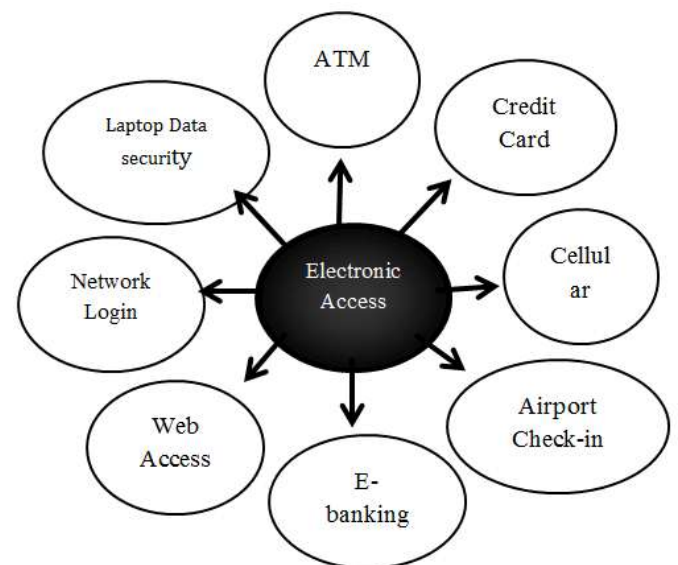

Figure 1: Various applications of e- access

Personal: Personal Computer login access, Mobile unlocks access, PDA, home security, digital wallets, etc.

Commercial: ATM, E-commerce, health record management, electronic data security, attendance at workplace, hostel attendance systems, service access, etc.

Government: Nations ID like AADHAR, driving license, voter id, welfare disbursement, passport, railway, airways, etc.

Forensic: person identification, Criminal investigation, law enforcement applications etc.

6. FINAL RESULTS BY MASTER ALGORITHM

Overall results for the proposed system by using all the technique in a master algorithm are presented in this section. The screen shot of the result shown by proposed algorithm is given as in figure.
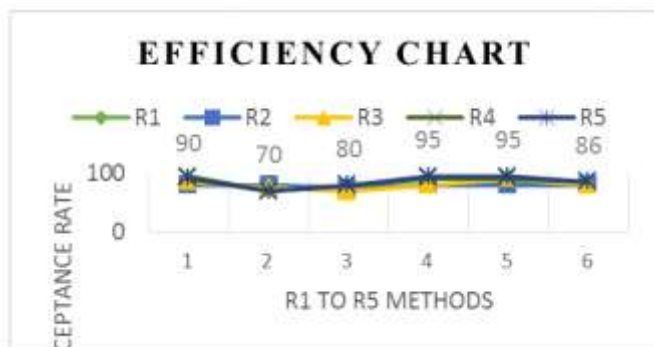

Fig. 2: Screenshot showing results

Fig. 3: Graphical representation of 5- fold results obtained by master algorithm using all the above techniques**.**

7. CONCLUSION

The proposed algorithm of fingerprint based gender identification using above 5 techniques from R1 to R5 when used combine, gives the average 86 percent results.

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