BIOMETRIC RECOGNITION USING MULTIMODAL TECHNOLOGY

Priya Yadav[1],Gauri Singh[2],Gladish Swain[3],Pragati Srivastava[4]

[1,2,3,4]Department of Computer science Engineering,DCE gurgaon(India)

ABSTRACT

Biometric is expressed as the science of identifying an individual on the basis of their physiological or behavioral traits. It seems to achieve acceptance as a rightful method for ob-taining an individual's identity. Multimodal biometric systems are widely used for different security applications. Major usage of such systems is in authentication and identification purpose, for example, authorized access control or terrorist identification, unique identity for human being etc.

Keywords: Biometrics, , DNA Recognition, Fingerprint Recognition , Iris Recognition

I. INTRODUCTION

Biometric is expressed as the science of identifying an individual on the basis of their physiological or behavioral traits. It seems to achieve acceptance as a rightful method for obtaining an individual's identity . Biometric systems possess numerous advantages like, it is difficult to share and reproduce, it is user friendly. i.e. there is no need to remember long and random passwords, it cannot be obtained by direct observation and it safe-guards against repudiation by the user.

Biometric systems that generally utilize a single attribute for recognition are influenced by some practical issues like noisy in sensor data, non-universality and/or lack of distinctiveness of the biometric trait . Multimodal biometric systems prevail over some of these issues by strengthening the proof acquired from several sources. It is believed that to enhance the performance of the sys-tem by providing more valuable information to the classifier. Bio-metric traits are acquired from multiple sources to recognize a per-son. Different characteristics can be examined by a single system or separate systems that functions on its own and their decisions can be merged together

This paper focuses on the feature level fusion approach for creating multibiometric template due to two reasons: (i) it provides synergetic (complimentary) information for identification and (ii) it contains raw data (more information) as compared to decision level . This work investigates the feasibility of creating a single multibiometric template using similarity measure.

The fingerprints and irises decompose very soon after the death of a person but the DNA sequence never decomposes. Thus, it is always important to use fingerprints, iris image, and DNA features based multimodal system for identifying a dead and an alive person. Hence, we have reviewed and analyzed the performance of fingerprints, iris, and DNA features based multimodal systems in this research work.

2. IRIS RECOGNITION SYSTEM

The iris is a thin, circular structure in the eye, responsible for controlling the diameter and size of the pupil and thus the amount of light reaching the retina. The color of the iris is often referred to as eye color.A front on-view of the iris is as shown in the figure below

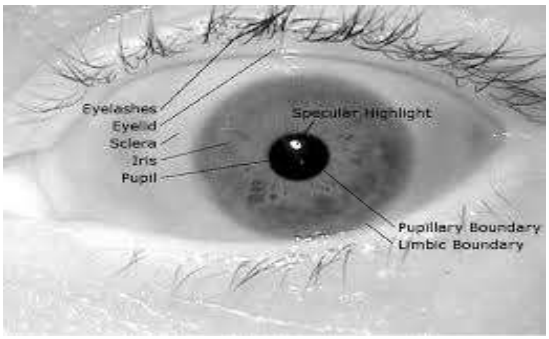


Fig1:Eyes structure

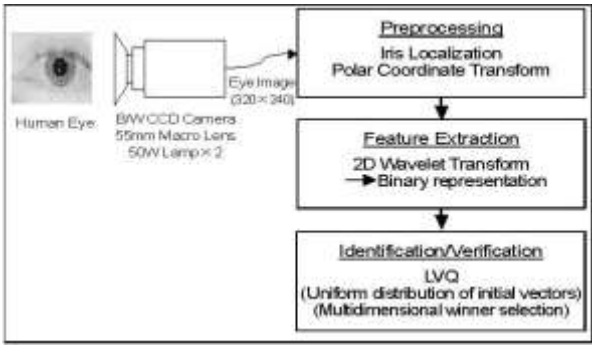


Fig2:Structure of proposed iris recognition system

Iris based identification is secure and accurate because, iris image doesn‘t change for the whole life of a person. The iris image fully develops in the first six months after the birth of a child. An Iris based identification system includes following four basis steps for identifying a person:

Step 1: Image Acquisition means capturing the iris Image using a high resolution camera.

Step 2:Image Preprocessing includes converting the image to a gray scale image and removing noise disturbances.

Step 3:Template matching compares the user templates with templates of database using a matching metric

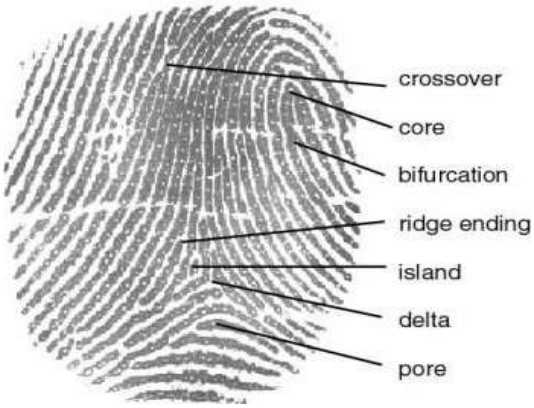
Step 4: Authentication uses the matching metric and declares a person either an authentic person or an imposter.

3. FINGERPRINTING SYSTEM

Fingerprint based systems describes the state-of-the-art of fingerprints based identification methods with advantages, disadvantages, and key features comparison. Traditionally, tokens such as physical key, personal ID cards, and passwords were used to identify a person. The various limitations of these automatic tokens are:

Fingerprints include the ridge, furrows, minutiae points, orientation of minutiae points, distances between minutiae points, whorl, and curves of fingerprints. Hand geometry based identification approaches use the geometric form of hand for confirming the identity of a person. Although, human hands are not unique but, few essential features such as hand length, finger length, finger width, palm length, and palm width may differ from one person to another person. In hand geometry based identification method the hand image is captured using a CCD camera for feature

extraction. In image pre-processing stage we extract the hand silhouettes and eliminate artifacts such as guidance pins; user rings; and overlapping cuffs. In hand silhouettes alignment we compute hand length, finger length, finger width, palm length, and palm width. The matching module compares user features with templates stored in database and generates the matching score.



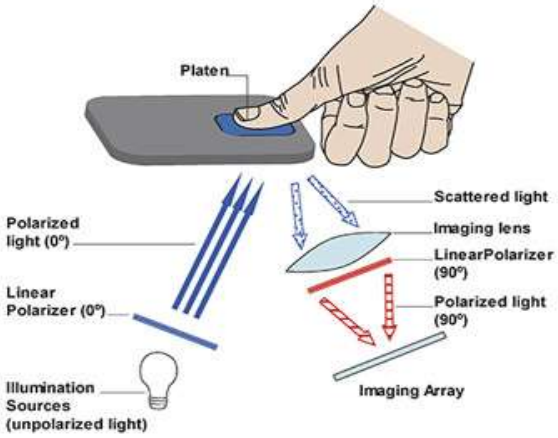


Fig3:Structure of human thumb **Fig4: Proposed finger recognition system**

The three basic patterns of fingerprint ridges are the arch, loop, and whorl:

- arch: The ridges enter from one side of the finger, rise in the center forming an arc, and then exit the other side of the finger.
- loop: The ridges enter from one side of a finger, form a curve, and then exit on that same side.
- whorl: Ridges form circularly around a central point on the finger.
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4. DNA RECOGNITION SYSTEM

Deoxyribonucleic acid (DNA) is the one-dimensional (1–D) ultimate unique code for one's individuality—except for the fact that identical twins have identical DNA patterns

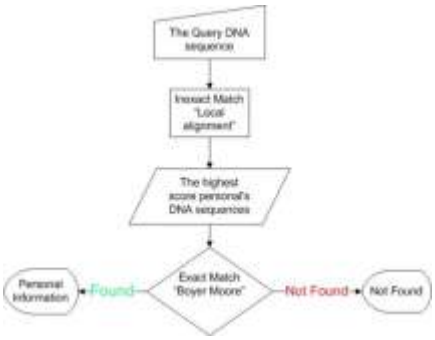

Fig5: Proposed DNA recognition system

5. MULTIMODAL BIOMETRIC SYSTEM

Multimodal biometric systems consolidate the evidence presented by multiple biometric sources and typically provide better recognition performance compared to systems based on a single biometric modality. Although information fusion in a multimodal system can be performed at various levels, integration at the matching score level is the most common approach due to the ease in accessing and combining the scores generated by different matchers. Since the matching scores output by the various modalities are heterogeneous, score normalization is needed to transform these scores into a common domain, prior to combining them.

6. LEVELS OF FUSION

A generic biometric system has 4 important modules: (a) thesensor module which captures the *trait* in the form of rawbiometric *data*;

(b) the feature extraction module which processes the data to extract a *feature set* that is a compact representationof the trait;

(c) the matching module which employs a classifier to compare the extracted feature set with the templatesresiding in the database to generate matching scores;

(d) the decision module which uses the matching scores to either determine an identity or validate a claimed identity.

In amultimodal biometric system informationreconciliation canoccur in any of the aforementioned modules

(a) Fusion at the data or feature level: Either the data itself orthe feature sets originating from multiple sensors/sources arefused.

(b) Fusion at the match score level: The scores generatedby multiple classifiers pertaining to different modalitiesare combined.

(c) Fusion at the decision level: The final output1 of multiple classifiers are consolidated via techniques such as majority voting [5].

Biometric systems that integrate information at an early stage of processing are believed to be more effective than those systems which perform integration at a later stage. Since the feature set contains richer information about the input biometric data than the matching score or the output decision of a matcher, fusion at the feature level is expected to provide better recognition results. However, fusion at this level is difficult to achieve in practice because the feature sets of the various modalities may not be compatible

7. DESIGN ISSUES

A variety of factors should be considered when designing a multimodal biometric system. These include

(a) the choice and number of biometric traits, (b) the level in the biometric system at which information provided by multiple traits should be integrated,

(c) the methodology adopted to integrate the information, and

(d) the cost versus matching performance trade off.

The choice and number of biometric traits is largely driven by the nature of the application, theoverhead introduced by multiple traits (computational demands and cost, for example), and the correlation between the traits considered (uncorrelated information is preferred since the performance improvement is more pronounced in this case). In a cell phone that is equipped with a camera, it might be easier to combine the face and voice traits of a user, while in an ATM application it might be easier to combine the fingerprint and face traits of the user. In identification systems comprising of a large number of users (in the order of millions), an indexing mechanism may be facilitated using a multimodal approach [15]. Researchers are currently studying the performance gain that can be obtained using state-of-the-art commercial off-the-shelf (COTS) fingerprint and face systems, on a large population of individuals [19].

8. CASCADED MULTIBIOMETRIC SYSTEM

• Capture biometric measurements as needed

(Sequential pattern recognition)

• Verification - reduces the average verification time

• Identification - successively prunes the database (indexing)

• To reduce the average verification time, the modalities must be cascaded in the decreasing order of accuracy

• In user-friendly systems, the user can be allowed tochoose the order of the modalities

9. SUMMARY AND CONCLUSIONS

Multimodal biometric systems elegantly address several of the problems present in unimodal systems. By combining multiple sources of information, these systems improve matching performance, increase population coverage, deterspoofing, and facilitate indexing. Various fusion levels and scenarios are possible in multimodal systems. Fusion at the match score level is the most popular due to the ease in accessing and consolidating matching scores. Performance gain is pronounced when uncorrelated traits are used in a multimodal system. Incorporating user-specific parameters can further improve performance of these systems. the widespread deployment of biometric systems in several civilian and government applications, it is only a matter of time before multimodal biometric systems begin to impact the way in which identity is established in the 21st century

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