

**Design a Secure and Effective Technique for
Personal Authentication on Noisy Iris Recognition**

Thesis Summary

for

Doctor of Philosophy
(Computer Science and Applications)



Thesis Summary

Introduction

In today's sensitive environment, Personal Authentication and Security of identity are the major challenges for an individual. The latest advancements in the IT era on personal authentication and their security move towards to biometric based automatic personal authentication system. Both are necessary in various real-life applications such as ATMs Transactions, Secure Online Fund Transfer, Passport Immigration, Secure Access to Offices or Buildings, E-Governance Services, Investing and other Financial Transactions, Law Enforcement, Military Security, Enterprise-wide Network Security Infrastructures, Retail Sales, Health and Social Services and other Commercial Services etc.; where each person has to authenticate his personal identity on a routine basis. But, person's identity theft, damage or corrupt the important & reliable data and their related domain security are challenging problems. Today, a person has multiple login ids with multiple passwords and used them on different number of computers and web domains on same or far locations. On such situations, handling and maintaining the personal identity and data security, have become very difficult.

For authentication and security, many traditional authentication mechanisms are available: System uses Login Id and Password; System uses Debit Card and Personal Identification Number (PIN) for banking transactions; System uses a Security Token or Smart Card; and System uses a fingerprint or other biometric trait for routine attendance. But, these traditional authentication mechanisms have many shortfalls like password or PIN thefts, Stealing of security token or smart card etc. To overcome these shortfalls of existing traditional mechanism; biometric authentication has been widely accepted, safest & popular technique.

Iris recognition is a specific or domain-bounded biometric authentication system to recognize the person effectively and reliably by analyzing the unique patterns found in the human iris. In comparison to other visual recognition techniques, the iris has a great advantage because there is a large variance of the pattern between individuals.

Iris recognition is widely accepted biometric technique for personal authentication due to several inherent properties of iris patterns, i.e., stability in lifetime, selectivity

and reliability. But, on image acquisition stage, the captured image of an eye from hardware-based source like sensors, digital camera etc. is suffered by noise. For example, iris image captured under unconstrained conditions and without user cooperation, nonlinearly deformed iris images, faked iris images, iris images with poor quality degraded by low illumination, off-angle view, angle rotation, motion blurring, occlusion by eyelids, occlusion by eyelashes, noises by glasses, occlusion, specular reflection (SR) all are some types of noise exist in iris images.

Since these factors reduce the similarity between intra-classes, the recognition performance is drastically degraded for personal authentication. In this study, new iris segmentation method is proposed to improve the performance for unconstrained image-acquisition environments.

Aim of the Study

The basic aim of this research study is to design an effective and secure technique for personal authentication using iris recognition and also evaluate the performance of the designed framework by comparing the performance of existing iris recognition system. The study also provides the iris template security mechanism to secure iris recognition system.

Objectives of the Study

The following are the objectives of this study.

1. To develop or improve existing algorithms to make the IRIS recognition accurately in possible on Noisy Iris Images.
2. Performance Evaluation of proposed framework by comparing the performance of existing Iris recognition system.
3. Design of a Security Template to secure Iris recognition system.

Findings in the Study

The major findings of the study can be summarized as under:

1. For making the iris recognition more accurate, an effective iris segmentation technique for noisy iris images is proposed.

2. The proposed effective iris segmentation technique for noisy iris images is implemented.
3. Performance evaluation of proposed segmentation framework with existing techniques for noisy iris images has been studied.
4. A hybrid protection mechanism is proposed to Secure Iris Template.

Outcome of the Study

The outcome of this study will represent the major achievements and promising avenues for future enhancements in the iris segmentation stage of the iris based biometric authentication system, which are likely to yield useful results. Biometrics can be used in verification and in identification mode. In identification mode, biometric sample is taken for further recognition purpose and in verification mode; the biometric system is used to authenticate the user's individuality.

Sometime it becomes difficult to recognize a user directly as noise may be present in iris images. Iris is a reflective mirror and is located behind the cornea. The resulting images could therefore be disturbed by specular reflections. The iris is also covered by eyelids in its upper, lower, both parts and also partially by eyelashes. It is very difficult to detect this noise as it has a random form and location. Blurred images can also be present in case of non-controlled acquisition conditions. During feature extraction phase, the uniqueness and discriminative level of the characteristics will determine the reliability of the recognition system. Therefore, unnecessary information must be discarded. A quantifiable set of features may be assigned to each of iris pattern obtained in this step, which will allow the computation of similarity measure between two iris patterns. The matching performance of a recognition system may also be affected by intra-class and inter-class variation and improper user interaction.

The basic approach of this study is to design a secure and effective technique for personal authentication on noisy iris recognition. The proposed iris segmentation technique for Noisy Iris Images consist six modules, namely determine the expected region of the iris using K-means image clustering algorithm; Apply the Canny Edge Detection algorithm; Apply the Circular Hough Transform on the binary edge image and find the Cartesian parameters; Upper eyelid localization; Lower eyelid

localization; Isolate the specular reflections and remove the pupil region to make the IRIS recognition accurate.

For experimentation and implementation, a dataset of UBIRIS v1, UBIRIS v2 and CASIA-IrisV4 iris image database has been used and the evaluation results clearly demonstrate that the proposed iris segmentation technique provides better accuracy in iris recognition rather than existing techniques for noisy iris images. This proposed technique can be used to improve an iris recognition system performance with low quality iris images. As per the results received after implementation, the proposed technique shows the 98.72% accuracy and at the same time the execution time of the proposed iris segmentation technique is 1.47 seconds. The Equal Error Rate (EER) of the proposed iris segmentation technique is very low i.e. 0.117.

The performance of the proposed segmentation framework is compared with existing techniques for noisy iris images with the help of parameter like False Non Match Rate (FNMR), False Match Rate (FMR) and Equal Error Rate (EER). The results clearly demonstrate that the proposed iris segmentation technique provides better accuracy and execution time rather than existing techniques.

To secure iris template, a hybrid protection mechanism is proposed. The proposed hybrid protection mechanism is comprised with proposed iris segmentation technique followed by non-invertible feature transformation and key-binding biometric cryptosystem. During the whole process, a random key will be generated by using Pseudo Random Key Generator; encode the key by applying Error Correction Encoder and store the resultant value into codeword. Resultant codeword and iris template will be integrated applying Key-binding biometric cryptosystem using fuzzy commitment scheme.

Establishing the individuality of a person with assurance is becoming precarious in a number of applications in an interconnected society. Biometrics is being gradually integrated in variety of applications which can be categorized into three main parts 1) Commercial applications such as Internet access control, computer login, e-commerce, e-banking, ATM or credit card, mobile phone. 2) Government applications such as registration of birth, death, voter etc. driver licence, passport, national unique identity card as AADHAAR etc. in India for social welfare

distribution. 3) Forensic applications such as corpse identification, criminal inquiry, missing children etc.

The proposed iris segmentation technique for noisy iris images as well as the proposed hybrid protection mechanism to secure iris template are the extension of existing traditional exploration process.

Organization of Thesis

The basic approach of this study is to design a secure and effective technique for personal authentication on noisy iris recognition. The present study has been organized into following chapters:

The first chapter introduces the biometric systems and their characteristics. The various measurable physiological and behavioural features of human being required for automated recognition has been discussed.

A detailed review of literature has been carried out in chapter 2. This chapter highlights the work of eminent researchers and explores the challenges in the area of personal authentication and iris recognition technology with their performance as well as Template Security. An extensive study about the literature in the field of iris recognition with noisy iris images, various iris segmentation techniques and iris template protection mechanisms is being carried out.

The aim and objectives of the study discuss in chapter 3 and also presents major challenges of iris recognition systems related to Iris Template Security and Iris Recognition Performance.

The chapter 4 highlights the materials and methods used in research methodology to achieve the mentioned objectives.

The chapter 5 focuses on the design of an effective segmentation technique for Noisy Iris Images to make the IRIS recognition accurate.

The chapter 6 highlights the performance evaluation of proposed segmentation framework with existing techniques for noisy iris images. Results obtained are consistent with the existing schemes.

Chapter-7 depicts a Hybrid Protection Mechanism to Secure Iris Template stored in the database.

The summary of our findings and conclusions of the study have been given in chapter 8. Some suggestions have also been mentioned for the further enhancement of the present study to make it more useful and fruitful for personal authentication.