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Low Quality Iris Detection in Smart Phone: A Survey

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Abstract — In this paper we will discuss iris recognition system on smart phone in non-cooperative environment and compare the main characteristics of the public and freely available iris image databases to find the suitable one to test feature extraction method of iris recognition on smart phone. These iris databases contributes rich amount of iris images which were taken in different environments. The paper is divided mainly into the five sections. Overview of prominent iris recognition methods is taken in section 1. Detailed reviews of the iris recognition on smart phone and how it works in section 2. Literature survey on iris analysis along with existing methods for iris feature extraction and encoding stage is detailed in section 3. Issues open for iris recognition methods in mobile phone are discussed in section 4. Finally, the inferences drawn from this literature survey and relevance of the proposed work have been defined in section 5.

Keywords— Iris recognition, Biometric techniques, Mobile phone, Pre-Processing, Feature Extraction

I. INTRODUCTION

Biometrics is the science and technology of calculating, computing and analyzing biological data. Biometric recognition is an efficient way to authenticate or verifying the identity of a living person based on physiological or behavioural characteristics. A physiological characteristic of a person is comparatively stable physical characteristics, such as palm print, fingerprint, facial feature, thermal emission, iris pattern etc. A behavioral characteristic is a reflection of an individual signature, speech pattern, gait, gestures. Biometrics system uses hardware sensor to capture the biometric information and software to update and store the biometric repository.

How Biometric technique works?

Biometric systems can seem to be complicated, but they all use the following steps:

Step 1: We have select the sensing device which have the intelligent sensors and gives the high performance.

Step 2: Now through the transmission system the biometric samples are transferred.

Step 3: Pre-processing of the biometric is done so that to remove to unwanted signals in the biometric samples as well as improve the degradation and correction of distortion in the biometric sample.

Step 4: In this step we extract or recognize the various features of the biometric samples as well as to reconstruct the features with the help of approximation algorithm to get the original biometric samples.

Step 5: Now we check the quality of the biometric sample :

```
If (Good quality biometric sample)
{
        If (OLD biometric sample )
        {
                Matching with the biometric samples and find the results and ;give analysis
        }
        Else
        {
                Store the biometric sample in the biometric repository;
        }
}
Else
{
        Goto step 1;
}
```

Step 6: if (old/new sample)

If new sample then set it in the repository for matching

Else we match with stored samples

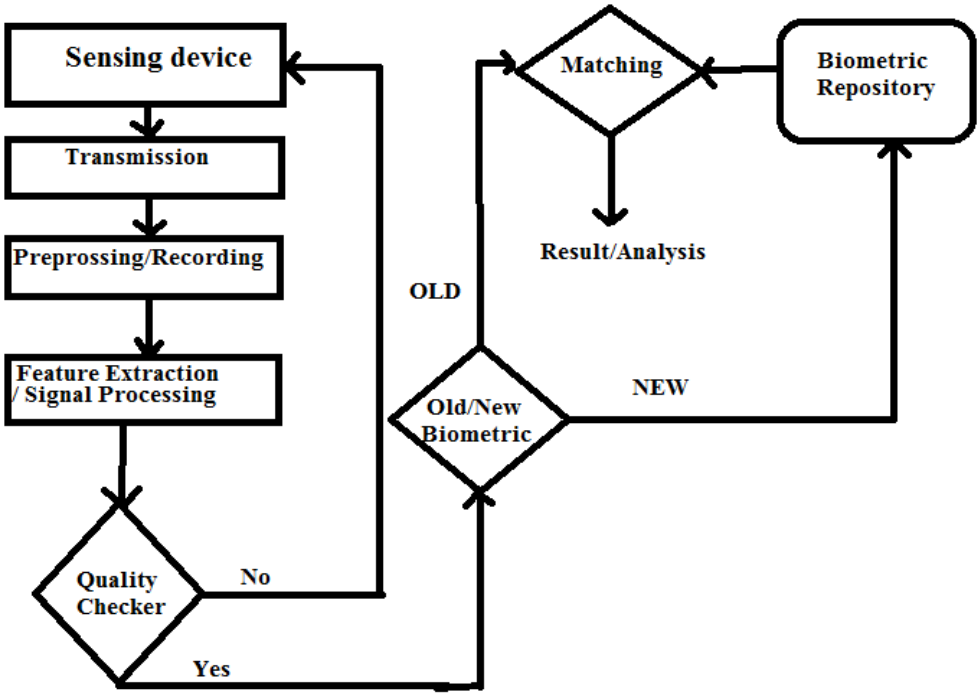

Fig-1 How Biometric Technology works

Types of Biometrics

DNA Matching: The identification of an individual using the analysis of segments from DNA.

Ear Biometric: The identification of an individual using the shape of the ear.

Eyes (Iris Recognition): The use of the features found in the iris to identify an individual.

Eyes (Retina Recognition): The use of patterns of veins in the back of the eye to accomplish recognition.

Face Recognition: The analysis of facial features or patterns for the authentication or recognition of an individuals identity. Most face recognition systems either use eigen faces or local feature analysis.
Fingerprint Recognition: The use of the ridges and valleys (minutiae) found on the surface tips of a human finger to identify an individual.
Finger Geometry Recognition: The use of 3D geometry of the finger to determine identity.
Gait: The use of an individuals walking style or gait to determine identity.
Hand Geometry Recognition: The use of the geometric features of the hand such as the lengths of fingers and the width of the hand to identify an individual.
Signature Recognition: The authentication of an individual by the analysis of handwriting style, in particular the signature.
Voice / Speaker Recognition: The use of the voice as a method of determining the identity of a speaker for access control.

II. WHY IRIS RECOGNITION?

The iris recognition of the eye has been the perfect part of the human being for biometric identification for several reasons:

- It is an internal organ that is well protected against damage and wear by a highly transparent and sensitive membrane (the cornea).
- The iris is mostly flat and its geometric configuration is only controlled by two complementary muscles that control the diameter of the pupil. This makes the iris shape far more predictable than, for instance, that of the face.
- Even genetically identical individuals (and the left and right eyes of the same individual) have completely independent iris textures.
- An iris scan is similar to taking a photograph and can be performed from about 10 cm to a few meters away.

How Iris recognition system works?

The first step is to capture the picture through special hardware using built-in mega-pixel camera . Then the eye is isolated and the inner and outer edges of the iris are located using complex image processing algorithms. Now noise removal processes are triggered to allow for eyelids, eyelashes and reflection and remove them from the analysis. Once the iris is located and isolated it is encoded using mathematical algorithms resulting in a code that contains the unique characteristics of the iris. Although, any two pictures at different times and in different conditions will not be exactly equal and the process is able to validate whether the iris belongs to that person or not.

How Iris recognition system on mobile phone

There are many more types of biometrics that could be implemented on mobile phones but several key factors should be considered when implementing such biometrics within a mobile phone. These factors will include user preference, accuracy and the intrusiveness of the application process. Table 1 illustrates how these factors vary for different types of biometrics.). The assigned accuracy category is based upon reports by the International Biometric Group (IBG, 2005) and National Physical Laboratory (Mansfield et al., 2001).

Table -1 Comparison of different biometric techniques for mobile phone

Biometric technique	**User preference from survey**	**Accuracy**
Ear shape recognition	NA	High
Facial recognition	Medium	High
Fingerprint recognition	High	Very High
Hand geometry	Medium	Very High
Handwriting recognition	NA	Medium
Iris scanning	Medium	Very High
Keystroke analysis	Low	High

Recently, Iris recognition technology has been make practical and effective use for the security of mobile phones. Iris recognition provides high level of security for cellular phone based services for example purchasing of goods from shopping site , internet banking transaction service via mobile phone. Users and equipment manufacturers have been drawing attention to the incorporation of Iris authentication in mobile phone to prevent misuse when the mobile phone is lost or stolen. But the implementation of iris biometric on mobile phone is totally dependent on the iris image quality. The high quality of iris images was achieved through special hardware design and using built-in mega-pixel camera. Considering the relatively small CPU processing power of cellular phone a new pupil and iris localization algorithm for cellular phone platform was proposed based on detecting dark pupil and corneal secular reflection by changing brightness & contrast value.

III. LITERATURE SURVEY

Literature review is done with the aim of gaining knowledge of the existing problems in the recognition of Iris and identification of issues related to feature extraction. Also to know that what new can be added to the existing methods of iris recognition on mobile phones.

Weizhi et.al. [1] Surveyed the development of existing biometric authentication techniques on mobile phones, particularly on touch-enabled devices, with reference to 11 biometric approaches (five physiological and six behavioural). They presented taxonomy of existing efforts regarding biometric authentication on mobile phones and analyze their feasibility of deployment on touch-enabled mobile phones. In addition, they systematically characterized a generic biometric authentication system with eight potential attack points and survey practical attacks and potential countermeasures on mobile phones.

Park K et.al. [2] proposed a new pupil & iris segmentation method apt for the mobile environment. They find the pupil & iris at the same time, using both information of the pupil and iris. And we also use characteristic of the eye image. Experimental result shows that our algorithm has good performance in various images, which include motion or optical blurring, ghost, specular reflection and etc. from various environments for iris recognition system.

Maria De Marsico et.al. [3] gave FIRME (Face and Iris Recognition for Mobile Engagement) as a biometric application based on a multimodal recognition of face and iris, which is designed to be embedded in mobile devices. Both design and implementation of FIRME rely on a modular architecture, whose workflow includes separate and replaceable packages. The starting one handles image acquisition. From this point, different branches perform detection, segmentation, feature extraction, and matching for face and iris separately. As for face, an antispoofing step is also performed after segmentation. Finally, results from the two branches are fused. In order to address also security-critical applications, FIRME can perform continuous re-identification and best sample selection.

Silvio Barra et.al. [4] used ubiquitous platform to verify owner identity during any kind of transaction involving the exchange of sensible data. Among the aforementioned biometrics, iris is known for its inherent invariance and accuracy, though only a few works have explored this topic on mobile devices. In their paper, a comprehensive method for iris authentication on mobiles by means of spatial histograms is described. The proposed approach has been tested on the MICHE-I iris dataset, featuring subjects captured indoor and outdoor under controlled and uncontrolled conditions by means of built-in cameras aboard three among the most diffused smartphones/tablets on the market.

Raghavender Reddy Jillela et.al. [5] discussed the suitability of using the iris texture for biometric recognition in mobile devices. One of the critical components of an iris recognition system is the segmentation module which separates the iris from other ocular attributes. Since current mobile devices acquire color images of an object, they conduct a literature review for performing automated iris segmentation in the visible spectrum.

Yung-Fu Chang et.al. [6] presented a theoretical foundation for proposing smart phone as the choice of client platform for mobile commerce (M-Commerce). After describing smart phone's great market potential and its popularity in telecom world, they provided the details of system requirements and the ideal characteristics of the client platform from system viewpoint and from benchmark metrics aspect. Although the current smart phone design still has some way to go before its becoming an ultimate platform, the improvement in smart phone design and the technological advances will reach the stage of its being used as M-Commerce platform over the next few years.

Kurkovsky et.al [7] in their paper described an approach to adapt iris recognition for resource-constrained mobile phones by reducing its computational complexity. Experimental results indicate adequate run time and quality of recognition that is comparable to other, more complex iris recognition systems developed for mobile devices.

Radu et.al [9] stated that for an iris recognition system to be deployed on common hardware devices, such as laptops or mobile phones, its ability of working with visible spectrum iris images is necessary. Two of the main possible approaches to cope with noisy images in a colour iris recognition system are either to apply image enhancement techniques or to extract multiple types of features and subsequently to employ an efficient fusion mechanism. The contribution of the present paper consists of comparing which of the two above mentioned approaches is best in both identification and verification scenarios of a color iris recognition system.

Huiqi Lu et.al [10] used a mobile authorization application to demonstrate using an integrated Symbian development environment to support wireless network [8] [11] [14] [19] connections and protect information security. In their paper, a Mobile Biometric Identification (MBI) system is introduced.

Fletcher et.al [12] implemented two low-cost hand vein scanner devices for use with mobile devices. The first scanner device employs the internal camera of the an Android smart phone along with a rechargeable infrared light (850nm) and an external optical filter; and the second scanner device employs a low-cost webcam, with integrated LEDs (940nm) and optical filter, which is powered directly from the Android tablet. A single mobile app was developed for use with both scanner devices with the ability to adjust scanner settings, capture hand palm images, and annotate patient data.

Jin-Suk Kang et.al [13] considered the limited computing power of mobile and portable devices; a simple but efficient pre-processing method is introduced for iris localization for such iris images. An iris database (http://chungbuk.ac.kr/Iris/index.html) with such consideration is created for their paper. The proposed iris pre-processing method implements the following steps: (a) Automatic segmentation for pupil region, (b) Helper data extraction and pupil detection, etc (c) Eyelids detection and feature matching. Experiment results showed that the proposed iris pre-processing method is performing well and stable across different iris databases.

IV. ISSUES OPEN FOR IRIS RECOGNITION ON MOBILE PHONES

- FTE refers to failure to enroll is main issue of iris recognition on mobile phones having an 7% FTE that is more than any of the biometric techniques.
- FNMR refers to non-match error rate of iris recognition is 6% and its also very high compare to other biometric techniques.
- Recognition of the iris when the individual is varying template like spectacles with different type, shape, colors and textures.

V. CONCLUSION

The main intension of this paper research is the development of reliable recognition based on iris images captured, without requiring the subject's cooperation and under heterogeneous lighting conditions in an uncontrolled environment. The dynamics of the imaging environments lead to the appearance of highly heterogeneous images with the iris information corrupted by several types of noise such as eyelashes and eyelids, pupil dilation and image rotation due to head tilt and camera rotation. These images significantly increase the difficulty of performing reliable recognition, which is a problem identified by several authors.

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