Chapter 10
Iris Identification System: A New Perspective

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ABSTRACT

Recent research on iris is not only on recognition; emerging trends are also in medical diagnostics, personality identification. The iris based recognition system rely on patterns/textures present in the iris, the color of the iris, visible features present in the iris, geometric features of the iris and the SIFT features. An overview of biometric generation is presented. Human iris can be viewed as a multilayered structure in its anterior view. The iris consists of three zones, the pupillary zone, collarette and the ciliary zone. The texture features present in the pupillary zone and collarette are used for identification. As these features are closer to the pupil they are not affected by the occlusion caused by eyelid or eyelashes. The geometric features of the iris can also be used for human identification. The structure of the iris is more related to the geometric shape and hence the extraction of these features is also possible. An overview of the performance metrics to evaluate a biometric system is also presented.

INTRODUCTION

Traditionally, identification of a genuine person was based on key, password, magnetic or chip card. However, all of these can be stolen, forgotten or forged and hence password and token-based recognition systems are nowadays replaced by biometric recognition system. Even in some systems where password and token are still used, on top of it a biometric layer is added for more secure authentication. Hence there is a tremendous growth in biometric based identification system in almost all paths round the world. Biometric includes reference to the measurement, analysis, classification, science of personal recognition and verification or identification by using distinguishable biological (physiological) or behavioural trait, features or characteristic of that person. Biometric identification is the process of associating an identity to the input biometric data by comparing it against the enrolled identities in a database (Jain et al., 2004).

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Iris Identification System

Depending on the mode of application biometric system operate on verification or identification mode. In verification mode, the system validates a person’s identity by comparing the captured biometric data with their own biometric template stored in the database; say by 1:1 matching. In identification mode, the system recognizes the person by searching the template of all the users in the database, where 1: N matching is performed. Any biometric system should possess the characteristics such as: versatility, uniqueness, permanence, measurability, performance, acceptability and circumvention. Among the various available biometric traits such as face, fingerprint, palm print, hand geometry, keystroke, signature, voice and gait, iris is proved to hold all characteristics for an identification system. Fingerprint, face and hand voice have been extensively studies for a comparatively longer period than iris, but iris is reported to be the most reliable biometric trait in identification and authentication (Bowyer & Flynn, 2008; Ross et al., 2006). It is claimed for two reasons that iris is unique and stable throughout the life time of an individual. The first is based on the biological development. The structure, appearance and colour are genetically inherited. The texture and other visible characteristics or features are epigenetic, hence the distinctive features. The second reason is based on the analysis made to the feature present in the iris. Even though there are cases like aniridia (an absences or undeveloped iris), corectopia (displacement of pupil), coloboma (missing or distortion in pupil) which are very rare and hence the uniqueness and stability of iris is taken for recognition. This chapter deals with the overview of the iris recognition system and with combination of other biometric system.

OVERVIEW OF BIOMETRICS

Biometric includes reference to the measurement, analysis, classification, science of personal recognition and verification or identification by using distinguishable biological (physiological) or behavioural trait, features or characteristic of that person.

Generation of Biometrics

The biometric system that is identifiable human dates back to the 19th century as Bertillon system. Since the evolution of the biometric system fingerprint was the only biometric traits used for identification that too only for criminal identification. The generation of biometrics (Jain & Kumar, 2010) are:

- **Zeroth Generation Biometrics System:** The biometric trait that falls in this generation is fingerprint and hand geometry. The systems were not automated and were also stand alone. The performance and usage was also very weak. These systems were only primarily used by forensic and law department.
- **First Generation Biometrics System:** In this generation the physiological and behavioral traits were encompassed. On top of forensic and law, they were used in civil aviation and commercial system. The main drawback of this generation was performance, security, privacy, poor interoperability, storage and scalability.
- **Second Generation Biometrics System:** The second generation took up all the challenging issues of the first generation. The system developed during this generation was viewed in engineering perspective and social perceptive. Apart from fingerprint, iris, face other anatomical, behavioural and physiological traits were included for identification. Some of them are ear, footprint, periocu-