Chapter 14
Compressive Sensing for Biometric System

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ABSTRACT

Biometric system is used by many institution, organization and industry for automatic recognition of person. One of the main reason for popularity of used for biometric system is that the ability of the system to identify between an authorized person and unauthorized person. There are many challenges associated with the biometric system such as designing of human recognition algorithm, compression of biometric templates, privacy and security of biometric templates in biometric systems. This chapter gives an application of Compressive Sensing (CS) theory for solutions of the above mentioned challenges in biometric systems. Recent research and trends in a biometric system indicated that many challenging of biometric system problems are being solved using Compressive Sensing (CS) theory and sparse representation algorithms. This chapter gives an overview of sparsity property of various image transforms and application of compressive sensing and sparse representation with regards to biometric image compression, biometric image recognition and biometric image protection.

1. INTRODUCTION

The term "biometrics" is coming from the two Greek words "bio" means life and "metrics" means to measure (National Science & Technology Council, 2007). Biometrics are a generally used to describe physiological and behavioral characteristics of the individual. A biometric is measured physiological and behavioral characteristics of a person which can be used for recognition and authentication of person (National Science & Technology Council, 2007; ITU-T Technology Watch Report, 2009). Popularly biometric modalities such as fingerprint, face, iris, voice, signature and hand geometry is used for research and implementation of any biometric system. Nowadays, new biometric modality such as gait, retina, ear structure, odor and palm prints are existed and research is going on these biometrics modalities.

Figure 1. Various biometric traits (a) Fingerprint (b) Face (c) Iris (d) Palm print (e) DNA (f) Signature (g) Ear (h) Voice
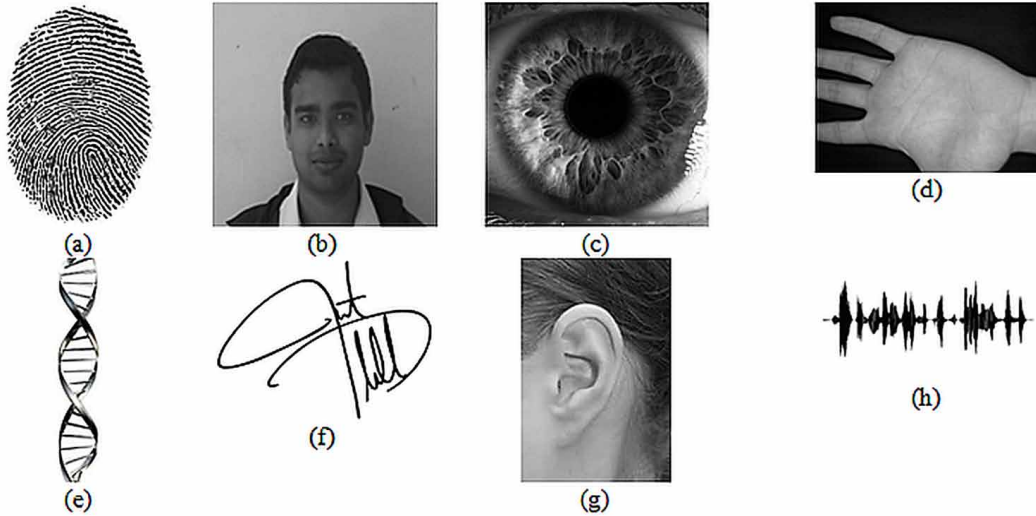
The Biometric is divided into two parts such as physiological trait and behavioral traits. Physiological traits are also known as passive traits. These traits are stable and invariant with time. The fingerprints, shape of face, hands, fingers or ears of the person, irises, teeth and samples of DNA are lying into physiological traits. The physiological traits of person are distinctive and permanent unless destroyed due to accident, illness (Jain & Kumar, 2012; ITU-T Technology Watch Report, 2009). Behavioral traits are also known as active traits. These traits are dynamics and vary with time. The gait, voice, keystroke and signature are lying into behavioral traits (Jain & Kumar, 2012; ITU-T Technology Watch Report, 2009). The various biometric traits are shown in Figure 1. Any biometric traits were following properties such as universality, distinctiveness, permanence and collectability.

- **Universality:** Every person should have own biometric traits.
- **Distinctiveness:** Any two people should not have same biometric traits.
- **Permanence:** The biometric should be invariant with time.
- **Collectability:** The biometric should collect easily.

A biometric system is a computerized system that uses physiological or behavioral characteristics information about person to identify that person. The automated biometric system is developed around 2000s due to significant research in the field of pattern recognition and computer processing (National Science & Technology Council, 2007). Many of automated biometric techniques are based on ideas that were originally conceived thousands of years ago. The most popular older technique is the recognition of individual by face. Persons are used faces to identify authenticated and unauthenticated individuals. Face recognition of person became more challenging task with increasing populations. So that person recognition has taken place by using other characteristics such as fingerprint, voice, iris and palm prints. There are various techniques used for person recognition throughout the history of civilization is available in the literature (National Science & Technology Council, 2007, pp. 55 – 56).

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