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CHAPTER 1 INTRODUCTION

Biometric systems are used for verifying a person's identity by analyzing unique physical or behavioural characteristics. Biometrics offer a more secure and reliable solution when compared to methods like passwords, Personal Identity Numbers (PIN), Identity cards etc. The most common types of biometrics used for security purposes are fingerprint, face, iris etc. Nowadays, from unlocking smartphones to controlling access in high-security zones, biometrics plays an important role.

Some challenges for biometrics include privacy concerns, spoofing attacks, and performance variations due to environmental factors etc. Research in this area focuses on improving the accuracy, precision and security of biometric systems.

1.1. CATEGORIES OF BIOMETRIC SYSTEMS

Biometric systems can be classified into physiological biometrics and behavioural biometrics.

a. Physiological Biometrics

Physiological biometrics deals with the unique physical characteristics of individuals. Physiological biometrics includes fingerprints, face, iris, retina, vein patterns, hand geometry etc. These biometric traits are generally inherent to the body and remain stable over time, making them reliable for security and identity verification systems.

- i. **Fingerprint Recognition:** This is one among the earliest and most used biometric techniques. The pattern of fingerprint captured from an individual is compared with a stored template for authentication. It is vulnerable to spoofing, i.e., fingerprints can be replicated using various methods, such as creating synthetic fingerprints or lifting prints from surfaces etc. User may be hesitant to use fingerprint scanners in public places due to hygiene concerns.
- ii. **Facial Recognition:** This biometric method analyzes the distinctive characteristics of an individual's face. Facial recognition systems use algorithms to detect attributes such as the gap between the eyes, the position of the nose and mouth to create a facial template for identification. Facial recognition technology has privacy concerns, as it can be used for mass surveillance and tracking without the consent of

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