ABSTRACT

Biometrics has come to occupy an increasingly important role in human identification due primarily to their universality and uniqueness. As a result of this evolution, a new breed of techniques and methods for user identity recognition and verification has appeared based on the biometric features that are unique to each individual. Examples of common biometrics used include iris, DNA, voice patterns, facial patterns and fingerprint. Out of this, the fingerprint is a more popular biometric modality and has been used for personal identification for more than 100 years. The popularity is due to the fact that fingerprints never change and no two fingerprints are similar. It has been proven that even identical twins have different fingerprints. Because of these desirable properties, automated systems for Automatic Fingerprint Identification and Authentication System (AFIS) have been developed and over the years this interest has increased steadily.

Although fingerprint matching based on minutiae features is a well researched problem in the field of AFIS, it can achieve very high accuracy given fingerprint images are same size or covering sufficiently large fingerprint areas, its accuracy is still far from being satisfactory when partial fingerprint images are available. While the introduction of compact silicon chip-based sensors that capture only part of the fingerprint has made this problem important from a commercial perspective and partial fingerprints obtained at crime scenes, there is also considerable interest in processing partial fingerprint matching. The need for recognition of partial fingerprints is increasing in both forensic and civilian applications.

The major challenges faced in partial fingerprint matching are the absence of sufficient minutiae features and other structures such as core and delta. Partial fingerprint matching needs lot of improvement. In order to improve the partial fingerprint matching accuracy, this research work explores proposes the use of features other than minutiae.
The main objective was to design a partial fingerprint recognition system based on non-minutiae features which would operate efficiently on the extremes of all three axis simultaneously (high accuracy, high scalability and easy to implement and use).

The proposed Automatic Fingerprint Recognition System (APFS) consists of three major steps. They are Acquisition (Sensors and data storage components), Identification and Recognition and Decision process. A fingerprint sensor is used to collect fingerprints, which are converted to a digital format and are stored as template. The template is used during the decision process where a new fingerprint is compared with the template. After acquisition, an input partial fingerprint is presented and a search with template fingerprints is performed (one-to-many matching). The anticipated result of the search is a match or non-match. Using this result, a decision process was developed to make a system level decision.

The proposed model consists of preprocessing that proposed an automatic image enhancer to correct the contrast, brightness and gray level discrepancy and an enhanced vector median filter to remove the impulse noise present in the fingerprints. Two segmentation algorithms, enhanced Harris corner and Susan corner are proposed to extract the fingerprint from its background. This helps to reduce irrelevant features selected. Two features, Local Binary Pattern (LBP) around pores and SIFT, were extracted from the fingerprints, which were matched using a score-based algorithm and BPNN.

From the various experiments conducted, it could be seen that the use of LBP pore features combined with SIFT features for fingerprint recognition produces high accuracy and reduced errors. The fact that the proposed models produce accurate, fast and reliable recognition results proves that the proposed models are the best candidates for high security applications. In summary, Fingerprint Recognition is truly the “ultimate” biometric of all, because of the rich and unique pore patterns.