

H6: Fingerprint Image Processing

The banking industry reports that false acceptance rates at ATMs are as high as 30%, which results in financial fraud of US \$2.98 billion a year [21]. Roughly 4000 immigration inspectors at US ports-of-entry intercepted and denied admission to almost 800,000 people. There is no estimate of those who may have gotten through illegally. In other words, neither a PIN number nor a password is reliable. To partially solve these problems, the technology of biometric recognition has recently raised increasing interests. Biometrics is the science and engineering of using digital technology to identify or verify individuals based on the individual's unique physical, biological, and behavioral characteristics such as fingerprint, hand geometry, face, iris pattern, voice pattern, gesture, and digital signature [21].

This project asks you to develop and/or implement a personal identification system based on fingerprints. *You are encouraged to finish the following tasks.*

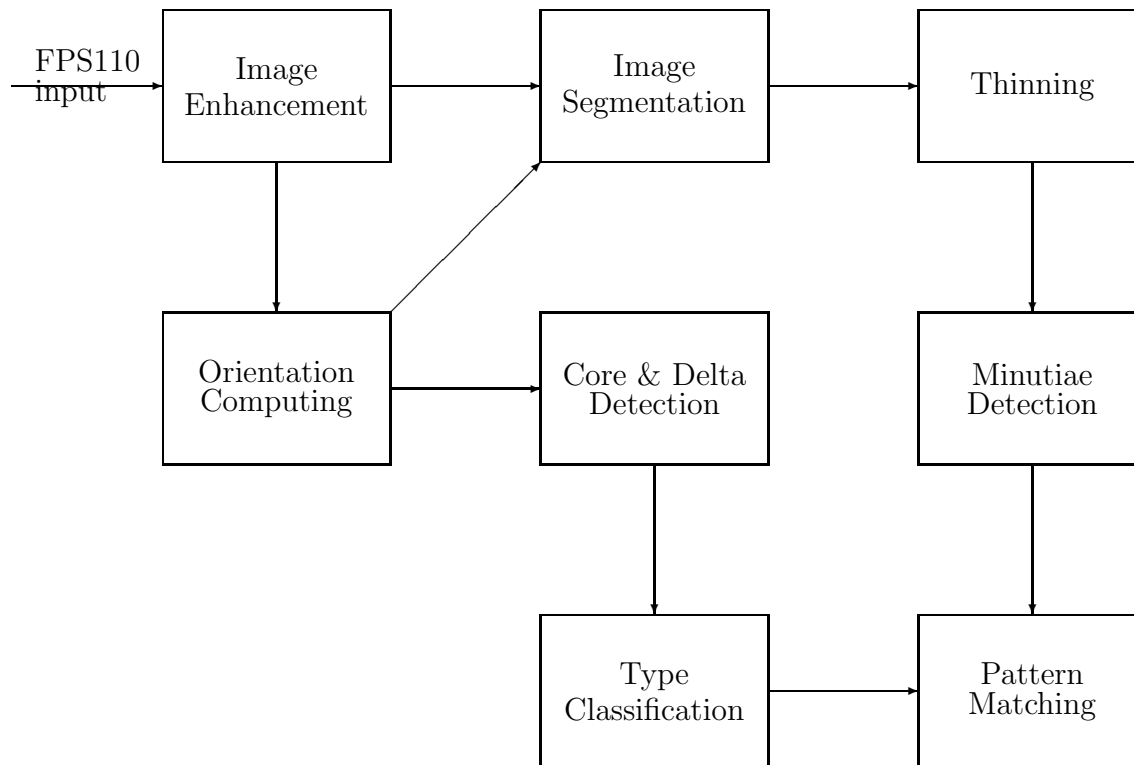
- (1) Investigate image enhancement algorithm based on the ridge direction to enhance input fingerprint images from a live scanner like Veridicom FPS110.
- (2) Investigate a robust fingerprint classification algorithm to classify fingerprints into 4~5 types [18].
- (3) Investigate an efficient minutiae matching algorithm using fingerprint classification for identification.
- (4) Evaluate the system using either a database acquired from a Veridicom FPS110 reader with 28 (101) persons in PRIP Lab at Department of Computer Science, National Tsing Hua University [27] or evaluate the performance using a database in [22], or FVC2002, FVC2004, FVC2006, FVC2008.

A Study on Fingerprint Image Analysis

A fingerprint verification system is to take a fingerprint image as input and processes part or all of the following steps.

- (1) Image Acquisition - a fingerprint image is requested from a fingerprint reader, e.g., Digital Persona, FPS110 by veridicom (1999~2000).
- (2) Region of Interest (RoI) detection.
- (3) Image enhancement - get rid of noise and attenuate the contrast.
- (4) Pixel classification - ridge, valley, or background.
- (5) Skeletonization - find all of the ridge curves or valley curves.
- (6) Type line finding - find pair(s) of special ridge curves called type lines, or valley curves.
- (7) Singular point localization - locate cores or deltas.
- (8) Minutiae search - computing the endings and/or bifurcations and their corresponding orientations tangential to the ridge curves.
- (9) Matching - compare the feature of the input fingerprint image with those prestored in the database to find the possible candidate for several best matches.

The research on fingerprint analysis generally strives to solve part of or all of the aforementioned procedure.



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