Fingerprint recognition
using FingerCodes

A. K. Jain, S. Prabhakar, and S. Pankanti, "**A Filterbank-based Representation for Classification and Matching of Fingerprints**", International Joint Conference on Neural Networks (IJCNN), pp. 3284-3285, Washington DC, July 10-16, 1999.
http://www.cse.msu.edu/~prabhaka/publications.html

Code (**Fingerprint Recognition Toolbox**) developed by Luigi Rosa, http://utenti.lycos.it/matlab

Overview of the method

- Implicit coding of the ridge structure using filterbank coding (as opposed to, e.g., minutiae representation).

- Consideration of the most discriminative (presumably) area of the fingerprint around the singular point.

- Functional relative invariance to scaling and rotation of the fingerprint.

Algorithm steps

- Image normalization and background segmentation.

- Localization of the singular point.

- Determination of the feature extraction points.

- Extraction of Gabor and statistical features (distance from mean) at the feature extraction points.

- Combination of the extracted features into one feature vector (FingerCode)

- Eventual comparison with the database (vector matching. In the basic implementation: Euclidian distance-based matching)
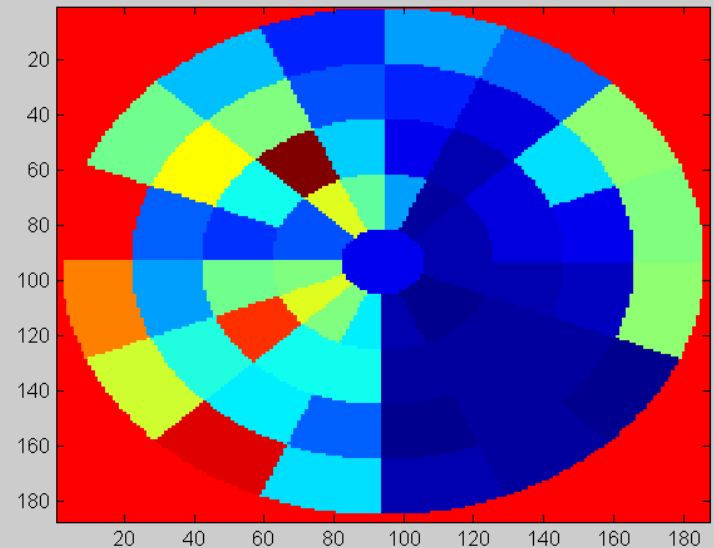
Singular point localization

- Discard background based on variance thresholding.
- Compute image gradients in x and y direction and compose z=(grad(Im,x)+i*grad(Im,y))
- Convolve resulting images with a complex core mask and find maximal response.

- Here's the singular point (but not necessarily)
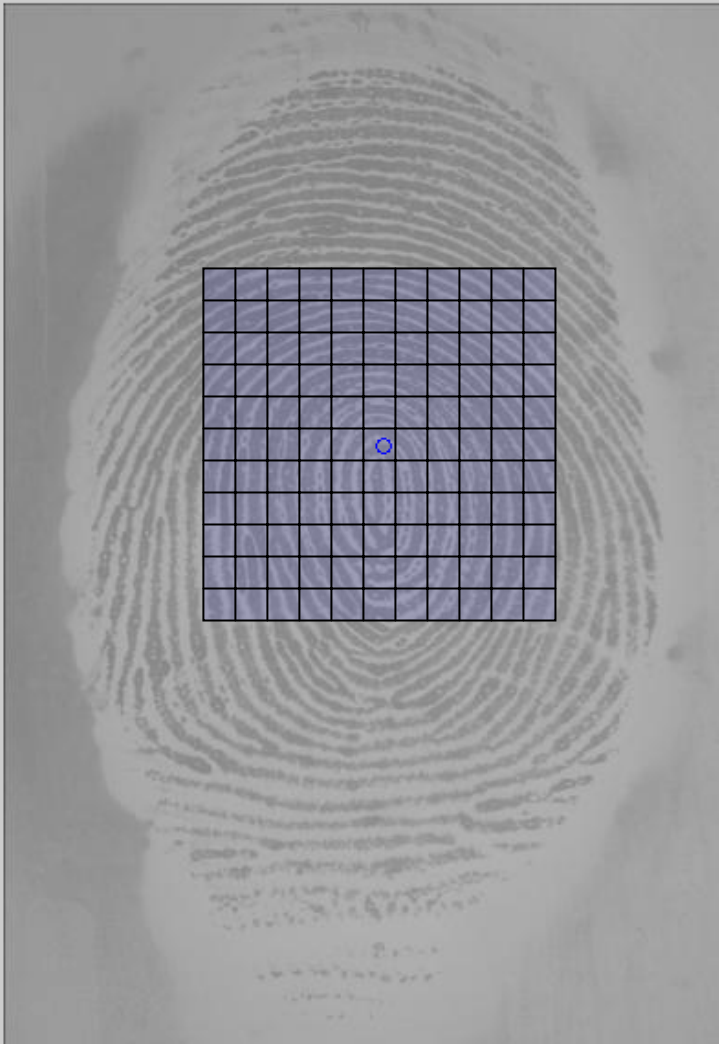
Localization of feature extraction points
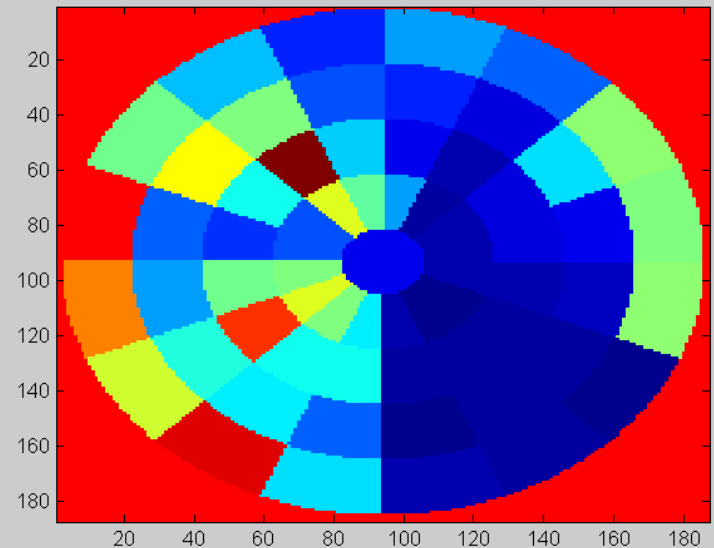

$$F_n(\Theta, r) = [AAD_n, G_n];$$

Total number of features=
2×8(filtered img.)×No.of rings×No.of angles

Localization of feature extraction points – rectangular mask

$$F_n(\Theta,r)=[AAD_n, G_n];$$

2×8(filtered img.)×No.of rings×No.of angles

Pros vs Cons

- ***Pros:***
  - Entire ridge structure is considered, rather than minutiae alone.
  - Relative invariance to rotation.
  - Computational efficiency.
  - Some robustness to bad quality of fingerprints.
  - Constant length of the feature vector.

- ***Cons:***
  - Depends heavily on the precision of singular point localization.
  - Fragile to elastic deformations.
  - Demands that there's enough room around the singular point for feature extraction.