We have separated our system into two halves: client-side and server-side. We present a system that performs matching using such images. Fingerprint registration and authentication is performed via a web interface. We also perform basic cropping, and convert a MATLAB processed fingerprint Image to a NBIS compatible image.

Methodology

**Fingerprint Matching**

- Registration
  - Image Preprocessing
    - Gray Scale image
    - Correction
  - Ridge Segmentation
    - Ridge Orientation
    - Ridge Frequency
    - Hole Filling
  - Fingerprint Image
    - Reliability Map
    - Masking
    - Thresholding Function
  - Matching Score
    - Matching module
    - Similarity Score

**Fingerprint Extraction**

- Segmentation
  - Lucy Richardson Deconvolution
    - ridge frequency
    - orientation image
    - ridge
    - ridge orientation
  - Bandpass Filter
    - ridge frequency
    - ridge orientation
  - Unsharpening
    - ridge frequency
    - orientation image
  - Bandpass filtering
    - ridge frequency
    - orientation image
  - Normalization
    - ridge frequency
    - orientation image
  - Ridge Frequency
    - ridge frequency
    - orientation image
  - Ridge Orientation
    - ridge frequency
    - orientation image
  - Ridge Filtering
    - ridge frequency
    - orientation image
  - Ridge Segmentation
    - ridge frequency
    - orientation image
  - Thresholding
    - ridge frequency
    - orientation image
  - Masking
    - ridge frequency
    - orientation image
  - Hole Filling
    - ridge frequency
    - orientation image
  - Mask
    - ridge frequency
    - orientation image

Results

In testing the performance of any fingerprint matching system, two types of errors need to be considered - False Non-Match Rate (FNMR) is the rate at which a genuine user is rejected by the system and False Match Rate (FMR) is the rate at which an impostor is accepted by the system. There is a natural tradeoff between these two values in any system, as having a more liberal acceptance policy will inevitably accept more impostors, and vice versa. To evaluate a system in general, the Equal Error Rate (EER), defined as the point at which FMR = FNMR, may be used. We found that 3 Enrollment Samples were ideal as it gave the lowest EER of 6.17%.

Conclusion

Our system has a number of merits that give it a significant edge over other authentication systems:

- The system adds an additional layer of security by implementing the webcam based fingerprint authentication system.
- As the registration and authentication system is accessible from a browser, it can be instantly deployed to any user who has access to a computer, a webcam, and a browser.
- As the only required hardware component is a low resolution camera (640 x 480), the deployment cost is very low.
- As the bulk of the processing happens on the server, clients can be built for any platform with great speed.

System Design

Unlike images from a traditional fingerprint scanner, fingertip photos obtained from a webcam suffer from low contrast, high noise, and blurring. We present a system that performs matching using such images. Fingerprint registration and authentication is performed via a web interface. The images are sent to a server where an image enhancement module extracts the fingerprint. A matching module then computes a similarity score for each pair. Fingerprint matching relies on features known as minutiae: ridge ending and bifurcation. We have separated our system into two halves: client-side and server-side. We perform Image processing, converting a grayscale image to a fingerprint image. We also perform basic cropping, and send it to the server securely.

**Client Side**

- Acquire the low resolution fingerprint image from the user.
- Send fingerprint image to the server securely.

**Server Side**

- Perform Image processing, converting a grayscale image to a fingerprint image.
- Perform Authentication using a fingerprint matching module.
- Send fingerprint Image to a NBIS compatible image.