Abstract

- As agencies build large databases of fingerprint images for purposes of confirming identity, it is clear minimum fingerprint image quality standards must be enforced [1].
- Additionally, there is a migration towards capturing four-finger slaps and submitting images using the Type 14 record format [2].

Improving fingerprint image quality starts at the point of capture

- This presentation describes a technique for controlling quality when capturing slap fingerprint images. The technique uses auto-capture and multi-sampling in the image acquisition software layer.
I/O Software has devised a technique named “Auto-Capture Using Multi-Sampling” for capturing slap images in its Live-scan Capture Suite (LCS) client Middleware product.

This technique is implemented in the image acquisition layer:
- Live-scan hardware does not need to support auto-capture
- Multi-threaded design allows user interface to present feedback while multi-sampling occurs
Multi-Sampling Process

- Images in live-scan buffer are evaluated frame-by-frame
  - Image pixel data is measured using quality comparators
  - Image is discarded if a quality comparator returns false
- Process is repeated with subsequent image frames
  - Image is auto-captured if every quality comparator returns true

*Note: Multi-sampling often implies averaging. In this process, only one acceptable image is captured. The process does not average multiple images.*
Quality Comparators

- Quality comparators have the following attributes
  - Accept slap or segmented finger image pixel input
  - Measure quality of image against minimum threshold
  - Return boolean result (true or false)

- Comparators are used in order
  - Fastest comparator is used first
  - Comparators that do not require segmentation are used first

- Sample set of comparators
  - Slap quality (pre-segmentation)
  - Minutia count (post-segmentation)
  - NFIQ finger quality (post-segmentation)
### Sample Data Points

**fr[i]**

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<thead>
<tr>
<th>Comparator</th>
<th>Measured</th>
<th>Threshold</th>
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<td>&gt;70</td>
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<td>Left Little</td>
<td>56</td>
<td>&gt;30</td>
</tr>
<tr>
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<td></td>
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<td>&lt;4</td>
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<tr>
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<td>Left Little</td>
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</tbody>
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**Failed Minutia Count!**
**Failed Slap Quality!**
**Passed!**

March 9th, 2006

*Auto-Capture Using Multi-Sampling - I/O Software*
User Interface Feedback

- Subject and operator see color borders around slap image during multi-sampling and auto-capture.
- Audible beep is heard while subject’s hand should remain on scanner.

Yellow border displayed during multi-sampling

Blue border appears during auto-capture

Boxes drawn around segmented fingers after auto-capture
Override Functionality

- Periodically, subjects have missing or badly damaged fingerprints.
  - Multi-sampling accepts quality images with missing fingers
  - Annotation tool can designate fingers as amputated or ‘unable to print’ before and/or after auto-capture

- Multi-sampling process will eventually force capture if no acceptable image is found
  - Fingers of low quality are automatically marked ‘unable to print’
    - EFTS Field 2.084
    - ‘UP’ designation
  - Operator can manually adjust boxes drawn around segmented fingers
Annotation Tool

Finger can be designated as amputated or unprintable before or after auto-capture.
Moveable Segmentation Boxes

Segmentation boxes can be manually resized after auto-capture.
Multisampling Capture Process Overview

Auto-Capture with Multisampling Image Capture Process

Frames From Scanner

Quality Comparators

User Interface

Stop Frames

TenPrint Flats Type-14

Frames

False

Stop Frames

True

User Intervention needed?

User Interface

Finger Quality Check

Segmentation & Scoring

Minutia Count Check

Finger Quality Check

Left 4 Fingers

Right 4 Fingers

False

Analyze Slap and if Image Pixel quality >= Threshold

Analyze Slap and if Image Pixel quality >= Threshold

Analyze Slap and if Image Pixel quality >= Threshold

False

March 9th, 2006

Auto-Capture Using Multi-Sampling - I/O Software
Conclusions

- Auto-Capture Using Multi-Sampling reduces image quality decisions made by operator
  - Operator no longer decides when to click capture
  - Quality comparators can be optimized based on use case

- User interface needs to assist operator when subject’s fingerprints do not exceed minimum quality
  - Annotation tool
  - Manually adjustable segmentation boxes
References


Questions and Answers

I/O Software, Inc.

6711 Lee Hwy, Suite #214
Arlington, VA 22205
T: (703) 738-9267
F: (703) 852-7914
www.iosoftware.com
info@iosoftware.com