ANSI/NIST Fingerprint Standard Update

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Michael McCabe
mccabe@nist.gov
fingerprint.nist.gov/standard
Standard Data Format for the Interchange of Fingerprint, Facial, & Scar Mark & Tattoo (SMT) Information

Transmission Standard describing the Fingerprint Data Interchange Format Used by Law Enforcement agencies

- FBI, DHS, SS
- State & local Police Agencies

De facto ISO Standard

- Canada, UK, Germany
- Eurodac, Interpol
History of ANSI/NIST Fingerprint Standard

- ANSI/NBS-ICST 1-1986 Minutiae-Based
- ANSI/NIST-CSL 1-1993 Image-Based 8-bit gray levels 500 ppi WSQ/15:1
- ANSI/NIST-ITL 1a-1997 Facial & SMT
- ANSI/NIST-ITL 1-2000 Tagged-field records higher resolution palms & latents
- ANSI/NIST-ITL 1-200X ?
Structure of Standard

- Sixteen defined record types - ASCII, binary, or combination
- Used to exchange information describing:
  - Transaction itself
  - Descriptive, demographic, and rap sheet
  - Finger and palm print image and minutiae
  - Facial image
  - SMT image and descriptive information
  - User defined type record.
<table>
<thead>
<tr>
<th></th>
<th>Logical Record Types</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transaction Information</td>
<td>ASCII</td>
</tr>
<tr>
<td>2</td>
<td>User-defined Descriptive Text</td>
<td>ASCII</td>
</tr>
<tr>
<td>3</td>
<td><strong>Low-Res F/P Grayscale Image Data</strong></td>
<td>Binary</td>
</tr>
<tr>
<td>4</td>
<td>High-Res F/P Grayscale Image Data</td>
<td>Binary</td>
</tr>
<tr>
<td>5</td>
<td><strong>Low-Res F/P Binary Image Data</strong></td>
<td>Binary</td>
</tr>
<tr>
<td>6</td>
<td><strong>High-Res F/P Binary Image Data</strong></td>
<td>Binary</td>
</tr>
<tr>
<td>7</td>
<td>User-defined Image Data</td>
<td>Binary</td>
</tr>
<tr>
<td>8</td>
<td><strong>Signature Image Data</strong></td>
<td>Binary</td>
</tr>
<tr>
<td>9</td>
<td>Minutiae Data</td>
<td>ASCII</td>
</tr>
<tr>
<td>10</td>
<td>Facial &amp; SMT Image Data</td>
<td>ASC/Bin</td>
</tr>
<tr>
<td></td>
<td>Record Type</td>
<td>Format</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>13</td>
<td>Latent Image Data (Variable-resolution)</td>
<td>ASCII/Binary</td>
</tr>
<tr>
<td>14</td>
<td>Tenprint Fingerprint Impressions (Variable-resolution)</td>
<td>ASCII/Binary</td>
</tr>
<tr>
<td>15</td>
<td>Palmprint Image Data (Variable-resolution)</td>
<td>ASCII/Binary</td>
</tr>
<tr>
<td>16</td>
<td>User-defined Testing Image Data (Variable-resolution)</td>
<td>ASCII/Binary</td>
</tr>
</tbody>
</table>
# Type 14 Record Example

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Field #</th>
<th>Data Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEN</td>
<td>14.001</td>
<td>N</td>
<td>14.001:40164 &lt;GS&gt;</td>
</tr>
<tr>
<td>IDC</td>
<td>14.002</td>
<td>N</td>
<td>14.002:01&lt;GS&gt;</td>
</tr>
<tr>
<td>IMP</td>
<td>14.003</td>
<td>A</td>
<td>14.003:0&lt;GS&gt;</td>
</tr>
<tr>
<td>SRC</td>
<td>14.004</td>
<td>AN</td>
<td>14.004:CA0000001&lt;GS&gt;</td>
</tr>
<tr>
<td>TCD</td>
<td>14.005</td>
<td>N</td>
<td>14.005:20040227&lt;GS&gt;</td>
</tr>
<tr>
<td>HLL</td>
<td>14.006</td>
<td>N</td>
<td>14.006:1600&lt;GS&gt;</td>
</tr>
<tr>
<td>VLL</td>
<td>14.007</td>
<td>N</td>
<td>14.007:1450&lt;GS&gt;</td>
</tr>
<tr>
<td>SLC</td>
<td>14.008</td>
<td>N</td>
<td>14.008:1&lt;GS&gt;</td>
</tr>
<tr>
<td>HPS</td>
<td>14.009</td>
<td>N</td>
<td>14:009:500&lt;GS&gt;</td>
</tr>
</tbody>
</table>
## Type 14 Record Example (continued)

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Field #</th>
<th>Data Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>VPS</td>
<td>14.010</td>
<td>N</td>
<td>14.010:500&lt;GS&gt;</td>
</tr>
<tr>
<td>CGA</td>
<td>14.011</td>
<td>A</td>
<td>14.011:1&lt;GS&gt;</td>
</tr>
<tr>
<td>BPX</td>
<td>14.012</td>
<td>N</td>
<td>14.012:8&lt;GS&gt;</td>
</tr>
</tbody>
</table>
Revision of 1-2000 Standard

- Open workshop held April 26-28, 2005 (NIST)
- ANSI requirement for a 5-year review
- Overview of major implementations
- New initiatives from the FBI/CJIS
- Talks on PIV and Quality indicators presented
- Review current ANSI/NIST-ITL 1-2000 standard
- Identify aspects of the standard for update
- Introduce new features for possible inclusion
Conclusions of 1st Workshop

- No authorized voting body established
- Modification and new features were presented but more definition of each item was needed
- A consensus of all present was that the standard should be updated and revised
- Further refinement of updates and enhancements was needed before inclusion in the standard
- Form 8 ad hoc groups to formalize update proposals
- Develop & circulate summary of the 1st workshop
- A second workshop should be convened
Ad Hoc Groups Formed

- Face - Compression issues, best practice, 3D
- UTF/GPS - Data encoding, GPS, tracking
- MISC - Iris & minutiae enhancements
- Latent Fingerprint Issues - 3rd Level details, Major case prints, impression types
- M1 harmonization - New record type & fields
- XML - Develop scheme compatible with standard
- LiveScan - Encoding of 3D fingerprint data
- Security - Standard guidance issues
INCITS M1 Technical Biometrics Committee

- INCITS/M1 committee created January 2002
- Purpose: To develop biometric data interchange format standards
  - Human examination and comparison
  - Computer identification and verification functions
  - Compact binary formats
  - Emphasis on verification for physical and logical access (commercial)
Data Format Standards

- Finger Image Data
- Finger Minutiae Data
- Face Image Data
- Finger Pattern Spectral Data
- Iris Image Data
- Hand Geometry Silhouette Data
- Signature/Sign Behavioral Data
- Pattern Skeletal Data
- Vascular Data

* ANSI/NIST
* COUNTERPART
*
Finger Image Data Format

- Used with CBEFF wrapper
- Image capture requirements for grayscale, amount of pixel data, and performance, commensurate with system and application requirements
- Use of numeric value for specific combination of image capture parameters
- Compact Fixed Binary Format
- NOT Readily Expandable
<table>
<thead>
<tr>
<th>ANSI/NIST Type 9</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutiae data as ASCII data</td>
<td>Minutiae data as binary data</td>
</tr>
<tr>
<td>Min. placement undefined</td>
<td>Min. Placement defined</td>
</tr>
<tr>
<td>Origin lower left corner</td>
<td>Origin upper left corner</td>
</tr>
<tr>
<td>Location in .01 mm</td>
<td>Location in pixels</td>
</tr>
<tr>
<td>Core/Delta X &amp; Y</td>
<td>Core/Delta X, Y &amp; Theta</td>
</tr>
<tr>
<td>Angle: 1.0 degree steps</td>
<td>Angle: 2.0 degree steps</td>
</tr>
<tr>
<td>No Proprietary data</td>
<td>Proprietary data</td>
</tr>
</tbody>
</table>
RIDGE ENDING SPECIFICATION

\[ \theta \]

valley

ridge
Why Harmonize
ANSI/NIST & INCITS/M1

☐ Provide systems the option of processing and converting information between ANSI/NIST and M1 data formats

☐ DOD uses IAFIS (fingerprint) and ABIS (iris, voice)

☐ HSPD12 / PIV card will use IAFIS for background checks and M1 data for verification
How to Harmonize ANSI/NIST & INCITS/M1

- Reserve a block of vendor-specific fields to mimic the M1-type fingerprint minutiae format (Similar to Cogent’s fields 31-->48)
- Define additional finger and palm image fields to specify image capture parameters, optional product identification, and image quality information
- Define additional face information fields to contain visible facial features.
How to Harmonize (continued)

- Define a new record type (17) for iris image data
- For biometric data types not addressed by ANSI/NIST define a new record type (18) to include required ANSI/NIST and M1 information fields
  - Provides the ability to exchange data formats used by M1 that are not currently recognized by ANSI/NIST
Logical Record Type 17
IRIS Image Record

- 17.001: LEN
- 17.002: IDC
- 17.004: Source Agency
- 17.005: Iris Capture Date
- 17.006: Horizontal Length (capture)
- 17.007: Vertical Length (capture)
- 17.008: CBEFF Product ID
- 17.009: Capture Device ID
- 17.010: Globally Unique ID
IRIS Image Record (continued)

- 17.011: Compression Algorithm
- 17.012: Bits per Pixel
- 17.013: Iris Position
- 17.014: Rotation Angle of Eye
- 17.015: Rotation Uncertainty
- 17.022: Iris Image Quality Scale
- 17.023: Iris Image Quality Value
- 17.999: Iris Image Data
XML Representations

- Four different approaches proposed

**Favored Approach**

- Develop a representation of the existing standard
- Map as closely as possible the existing records and numeric tags to XML tags
- Tag names to be descriptive of the element content
- Use the language of the text of the current standard
Create a tag name for the entire package
<ITL_Identification_Transmission_Package>

Create tag names for each logical record
<Tenprint_Fingerprint_Impressions>

Create tag names to replace all numeric tags
(for 1.004) <TypeOfTransaction>

Recommend Base64 Encoding for embedded binary data.
Latent Fingerprint Issues

- Develop an approach to encode first- and third-level details which may include:
  - pores
  - ridge edge shapes
  - ridge widths
  - dots
  - ridge relationships
  - ridge flow

- Require a minimum scanning resolution of 1000 ppi for the capture of latent images

- Develop codes and descriptions for major case prints

- Update Finger Impression Type table (swipe, etc.)
Face Image Proposals

- Allow color JPEG 2000 for compression to improve image quality
- Add provision for quality score and algorithm identification information
- Define fields for 3D pose angle (yaw, pitch, & roll)
- Include a facial image capture profile that addresses compression limits, capture requirements, and other best practice attributes or requirements.
### ADJUST MAX SLAP SIZES

*(Table 6)*

<table>
<thead>
<tr>
<th>Finger Position</th>
<th>Finger Code</th>
<th>Width (inch)</th>
<th>Length (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Right Thumb</td>
<td>11</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Plain Left Thumb</td>
<td>12</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Plain Right 4-Fingers</td>
<td>13</td>
<td>3.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Plain Left 4-fingers</td>
<td>14</td>
<td>3.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Plain Thumbs (2)</td>
<td>15</td>
<td>3.3</td>
<td>3.0</td>
</tr>
</tbody>
</table>
## ADDITIONAL PALM CODES

<table>
<thead>
<tr>
<th>Palm Position</th>
<th>Palm Code</th>
<th>Width (in)</th>
<th>Length (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Interdigital</td>
<td>31</td>
<td>5.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Right Thenar</td>
<td>32</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Right Hyperthenar</td>
<td>33</td>
<td>3.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Left Interdigital</td>
<td>34</td>
<td>5.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Left Thenar</td>
<td>35</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Left Hyperthenar</td>
<td>36</td>
<td>3.0</td>
<td>5.5</td>
</tr>
</tbody>
</table>
Interpol requirements:

- 10.003:CC/agency\(^G\) where
  - CC is 2 alpha-numeric characters
  - Agency is up to 32 characters

Proposal: Increase size of source agency /ORI to a maximum of 43 characters for all records Types 10 and above
Miscellaneous Issues

- Consider UTF-8 in place of 7-bit ASCII for user-defined fields to simplify international uses
- Formally specify codes for WSQ, JPEG, etc.
- Develop a GPS field for a mapping of location
- Develop a Submission Tracking Field to support traversing of vendors and jurisdictions
- Add additional field for attended operation
- Add additional fields for image quality and segmentation algorithm information
Development of the Revision to the Standard

- Schedule a 2nd workshop (December 5-6, 2005)
- Develop a Canvass List
- Convene 2nd workshop (December 5-6, 2005)
- Present findings of each ad hoc group
- Vote on each proposal for inclusion in standard
- Develop draft update: ANSI/NIST 1-200X
- Circulate for comment
- Edit draft
- Circulate for vote (30 day minimum)
- Submit to ANSI if approved; else update and
Standards Approval Considerations

- Consensus on a proposed standard by a group that includes representatives from materially affected and interested parties;
- Broad-based public review on draft standards;
- Consideration and response to comments from voting members of the consensus body;
- Incorporation of approved changes into a draft standard; and
- Right to appeal by any participant that believes that due process principles were not sufficiently respected during the standards development in accordance with the ANSI-accredited procedures.
More Information

fingerprint.nist.gov/standard

- Current and future drafts of standard
- Presentations made & summary of April 2005 workshop (NISTIR 7242)
- Method used to develop revision
- How to participate and become a canvasser
- Results of ad hoc groups
- Information and registration for 2nd workshop