ANSI/NIST Fingerprint Standard Update

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ANSI/NIST-ITL 1-2000
NIST SP 500-245

- 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.

ANSI/NIST-ITL 1-2000 Standard
Logical Record Types

1	Transaction Information	ASCII
2	User-defined Descriptive Text	ASCII
3	*Low-Res F/P Grayscale Image Data*	*Binary*
4	High-Res F/P Grayscale Image Data	Binary
5	*Low-Res F/P Binary Image Data*	*Binary*
6	*High-Res F/P Binary Image Data*	*Binary*
7	User-defined Image Data	Binary
8	*Signature Image Data*	*Binary*
9	Minutiae Data	ASCII
10	Facial & SMT Image Data	ASC/Bin

ADDITIONAL RECORD TYPES IN ANSI/NIST-ITL 1-2000

13	**Latent Image Data (Variable-resolution)**	**ASCII/Binary**
14	**Tenprint Fingerprint Impressions (Variable-resolution)**	**ASCII/Binary**
15	**Palmprint Image Data (Variable-resolution)**	**ASCII/Binary**
16	**User-defined Testing Image Data (Variable-resolution)**	**ASCII/Binary**

Type 14 Record Example

Field ID	Field #	Data Type	Example
LEN	14.001	N	14.001:40164 <GS>
IDC	14.002	N	14.002:01<GS>
IMP	14.003	A	14.003:0<GS>
SRC	14.004	AN	14.004:CA0000001<GS>
TCD	14.005	N	14.005:20040227<GS>
HLL	14.006	N	14.006:1600<GS>
VLL	14.007	N	14.007:1450<GS>
SLC	14.008	N	14.008:1<GS>
HPS	14.009	N	14:009:500<GS>

Type 14 Record Example (continued)

Field ID	Field #	Data Type	Example
VPS	14.010	N	14.010:500<GS>
CGA	14.011	A	14.011:1<GS>
BPX	14.012	N	14.012:8<GS>
FGP	14.013	N	14.013:14<GS>
DAT	14.999	N	14.999: <Image Data> <US>801<GS>

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

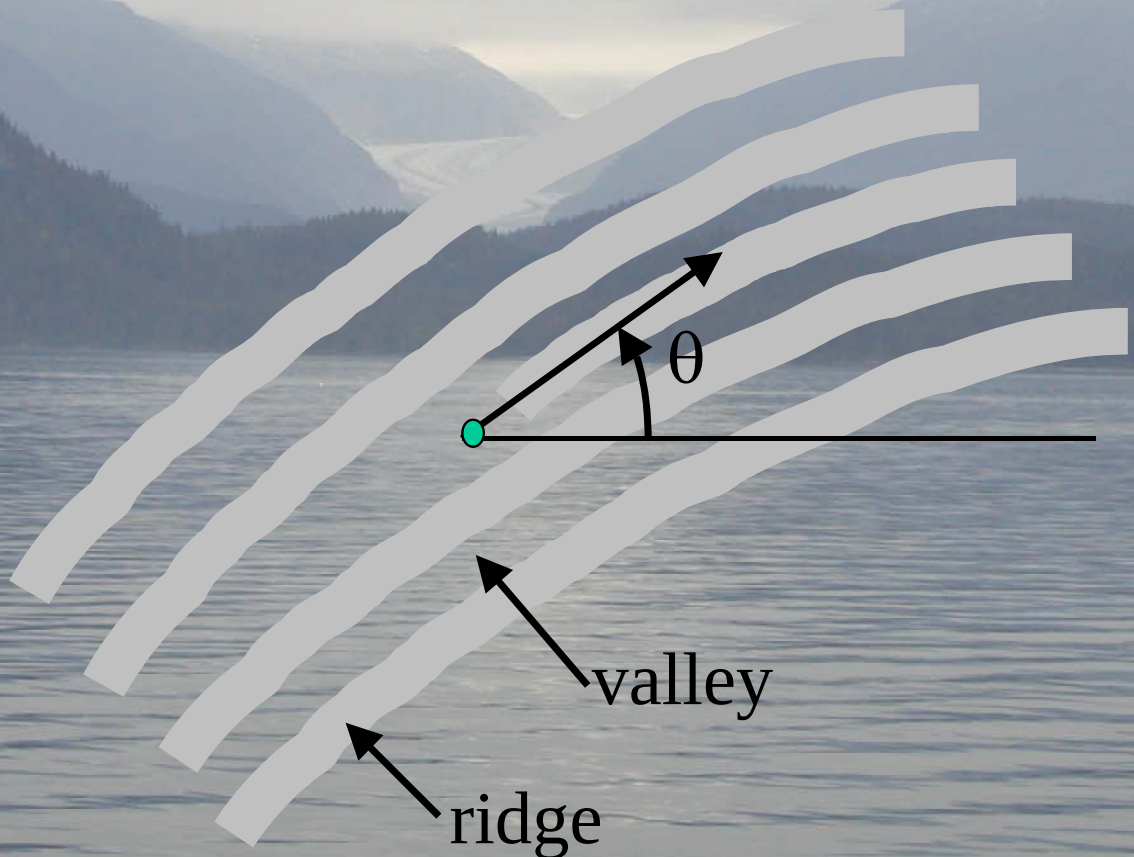
Finger Image Data Format

- 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

Minutiae Format Differences

- ***ANSI/NIST Type 9***
  - *Minutiae data as ASCII data*
  - *Min. placement undefined*
  - *Origin lower left corner*
  - *Location in .01 mm*
  - *Core/Delta X & Y*
  - *Angle: 1.0 degree steps*
  - *No Proprietary data*
- ***M1***
  - *Minutiae data as binary data*
  - *Min. Placement defined*
  - *Origin upper left corner*
  - *Location in pixels*
  - *Core/Delta X,Y & Theta*
  - *Angle: 2.0 degree steps*
  - *Proprietary data*

RIDGE ENDING SPECIFICATON



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

XML Sample

- 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 widths
  - ridge relationships
  - ridge edge shapes
  - dots
  - 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)

Finger Position	Finger Code	Width (inch)	Length (inch)
Plain Right Thumb	11	1	2.0
Plain Left Thumb	12	1	2.0
Plain Right 4-Fingers	13	3.3	3.0
Plain Left 4-fingers	14	3.3	3.0
Plain Thumbs (2)	15	3.3	3.0

ADDITIONAL PALM CODES

Palm Position	Palm Code	Width (in)	Length (in)
Right Interdigital	31	5.5	3.0
Right Thenar	32	3.0	4.0
Right Hyperthenar	33	3.0	5.5
Left Interdigital	34	5.5	3.0
Left Thenar	35	3.0	4.0
Left Hyperthenar	36	3.0	5.5

SOURCE AGENCY FIELD SIZE

- ***Interpol requirements:***
- ***10.003:CC/agency{$^{G}_{S}$} 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 canvassee
- Results of ad hoc groups
- Information and registration for 2nd workshop