Fingerprint Features Semantic Conformance
Terms / Definitions / Scope

Patrick Grother

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INCITS 378 Conformance Clause

2 Conformance

A system conforms to this standard if it satisfies the mandatory requirements herein for extraction of minutiae from a fingerprint image as described in Section 5 and the generation of a minutiae data record as described in Section 6.

Extraction of minutiae = semantic conformance
Check by referencing original image

Generation of record = syntactic conformance
Check by parsing and validating

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INCITS 378 on Placement

2004 :: 5.3.2 Minutia Placement on a Ridge Ending

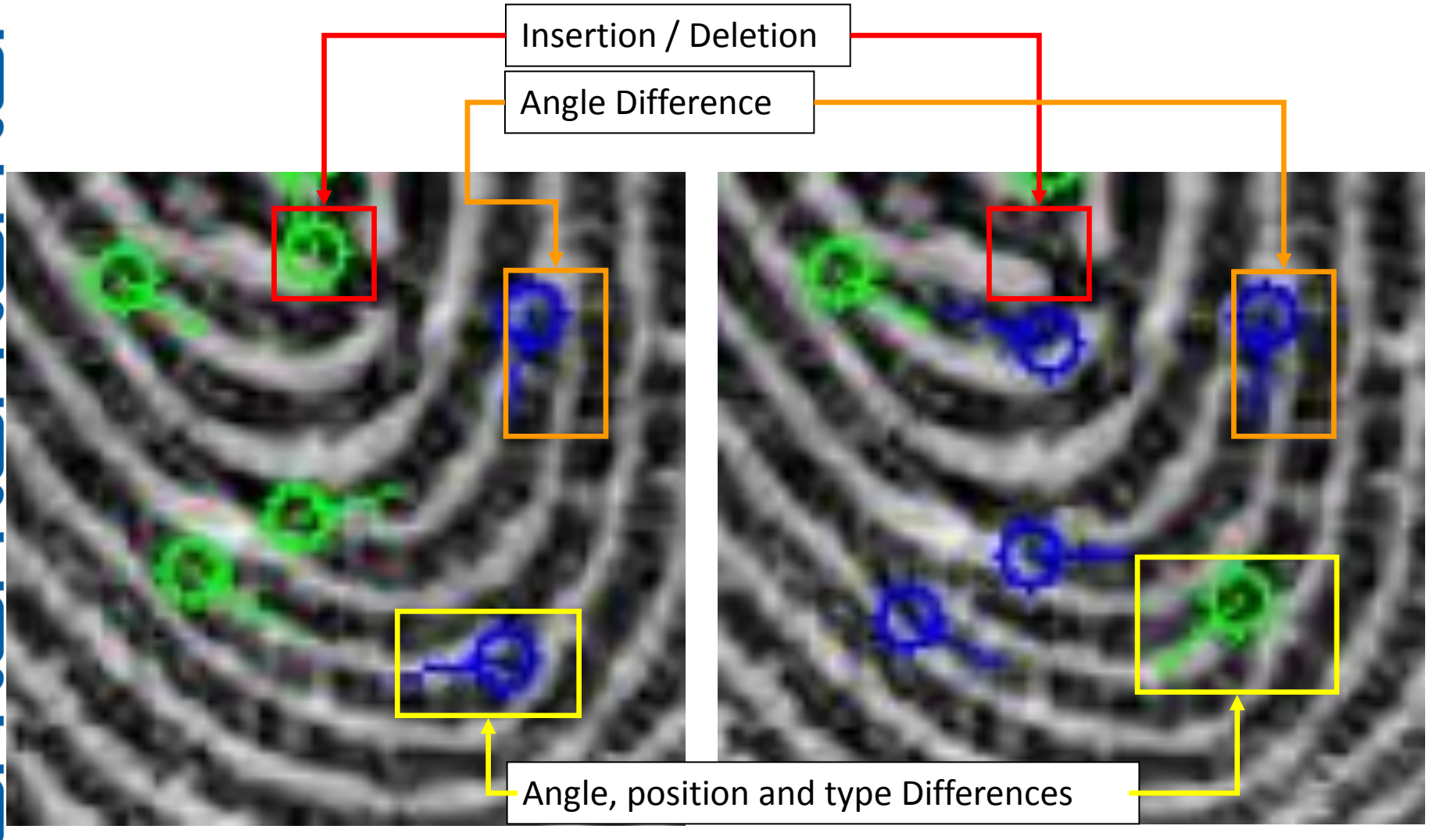
The minutia for a ridge ending shall be defined as the point of forking of the medial skeleton of the valley area immediately in front of the ridge ending. If the valley area were thinned down to a single-pixel-wide skeleton, the point where the three legs intersect is the location of the minutia. In simpler terms, the point where the valley "Y"s, or (equivalently) where the three legs of the thinned valley area intersect.

2007 :: 5.3.2 Minutia Placement on a Ridge Ending

The minutia for a ridge ending shall be defined as the point of forking of the medial skeleton of the valley area immediately in front of the ridge ending. If the valley area were thinned down to a single-pixel-wide skeleton, the point where the three legs intersect is the location of the minutia. In simpler terms, the point where the valley "Y"'s, or (equivalently) where the three legs of the thinned valley area intersect. A Ridge Ending shall be encoded only if all of the legs used to calculate the minutiae angle length (as defined in 5.4.2 – Angle of a Ridge Ending) are greater than or equal to 0.02 inches in length.

The standards contain analogous text for bifurcations also.

Minutiae from two products



Native vs. Proprietary

False Non-Match Rate at False Match Rate of 0.01	Supplier of Template Matcher		
		Proprietary	Native Standard
Supplier of Enrollment Template	NEC	0.0047	0.0129
	Cogent	0.0089	0.0136
	Sagem	0.0089	0.0140

PROPRIETARY	Representation of the template is completely unconstrained.
	Construe it to be the supplier's "best effort maximum accuracy" template.
NATIVE	Representation of the template is constrained by the INCITS 378 standard
	One supplier generates and matches the template.

Performance Interoperability

False Non-Match Rate at False Match Rate of 0.01		Supplier of Verification Template + Template Matcher		
		NEC		
Supplier of Enrollment Template	NEC	0.0129		

Red values refer to NATIVE performance : One vendor generates and matches all templates.

Performance Interoperability

False Non-Match Rate at False Match Rate of 0.01		Supplier of Verification Template + Template Matcher		
		NEC	Sagem	
Supplier of Enrollment Template	NEC	0.0129	0.0205	
	Sagem	0.0316	0.0140	

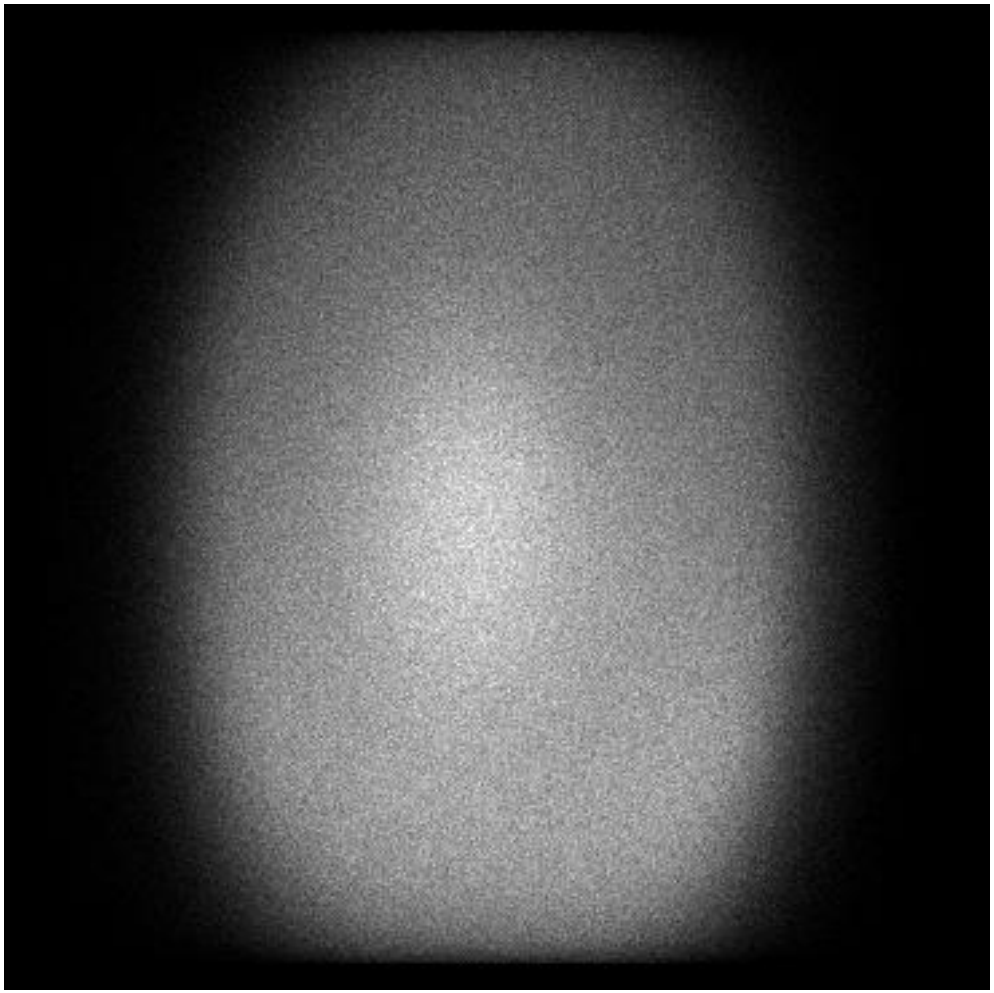
Red values refer to NATIVE performance : One vendor generates and matches all templates.

Performance Interoperability

False Non-Match Rate at False Match Rate of 0.01		Supplier of Verification Template + Template Matcher		
		NEC	Sagem	Cogent
Supplier of Enrollment Template	NEC	0.0129	0.0205	0.0300
	Sagem	0.0316	0.0140	0.0207
	Cogent	0.0417	0.0225	0.0136

Red values refer to NATIVE performance : One vendor generates both templates and matches them.

2D Minutiae Density



Intensity, $I(x, y)$, is proportional to the estimated likelihood that a minutiae will be found by a template generator at (x,y).

No registration applied.
No consideration of angle, type, class, or quality value.

Each 2D density function is estimated from ~ 72000 templates derived from 368x368 images collected using a single model of sensor.

These effects are observed for other optical sensors.

Order of appearance is not the alphabetic order of vendors in the MINEX reports

Terminology

"Conventional" Fingerprints

Rolled (ink capture)

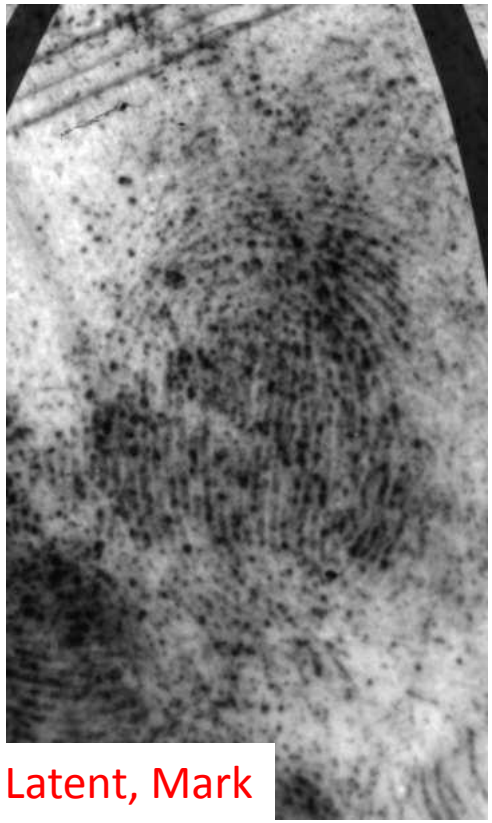
Ten-print roll, Exemplar

Flat (ink capture)

Flat, Exemplar

Latent Fingerprint

(powder "lift")



Latent, Mark

Traditional + Proprietary → EFS

Type 9 fields

- 5-12 Standard Format Features
- 13-30 IAFIS Features
- 31-55 Cogent Systems Features
- 56-70 Motorola Features
- 71-99 Sagem Morpho Features
- 100-125 NEC Features
- 126-150 M1-378 Features
- 151-175 Identix Features
- **300-399 Extended Friction Ridge Feature Set**

Traditional: Fields 9.005-9.012

- Minutiae
  - (x, y, theta, type, Q)
- Core
- Delta
- Ridge count

- Impression type
- Pattern class

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Extended Feature Sets :: Aims

- A “brave new standard”
  - Updates ANSI/NIST Type 9
  - Enhanced handling of traditional features
  - Larger “vocabulary” of features (e.g. “level 3”)
  - Includes features already present in proprietary sets
  - Intended to document everything seen by examiner
  - Archival format: inter-examiner markup, legal evidence
- NIST intent:
  - Quantitative support for draft standard (a la IREX, MINEX)
  - Bring standards-based implementations to market
  - Support iterative R&D

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Extended Feature Set

- Location + orientation
  - ROI, orient, finger + segment
- Ridge quality map
- Ridge flow map
- Ridge wavelength map
- Tonal reversal, lateral reversal
- Friction ridge quality metric
- Possible growth or shrinkage
- Cores, delta, core-delta ridge counts
- Distinctive Characteristics
- Minutiae
- Minutiae ridge counts + confidence
- Dots
- Incipient ridges
- Creases + linear discontinuities
- Pores
- Latent substrate
- Latent matrix
- No presence indicators
- Corresponding features

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