NIST Fingerprint Data

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Public Datasets

NIST Special Database 4

- 2,000 subjects with two instances
- Rolled/Single finger
- Scanned from inked fingerprint cards
- Lossless compression
- 400 from each fingerprint classification (left/right loop, whorl, arch, tented arch)
Public Datasets

NIST Special Database 9 and 14

• 2,700 subjects with two instances

• Rolled/Ten finger

• Scanned from inked fingerprint cards – some were printed live-scan cards

• Use same fingerprint images - Lossless (SD9) and WSQ (SD14) compression

• Fingerprint classification distribution not controlled.
Public Datasets

NIST Special Database 10

- 552 subjects with one instance
- Rolled/Ten finger
- Scanned from inked fingerprint cards – some were printed live-scan cards
- Lossless compression
- Concentrated on low frequency fingerprint classifications – arch and low count loops
NIST Special Database 24

- 20 subjects
- Plain/Single finger
- 10 samples (5 male/female) for all ten finger positions
- Video (MPEG-2) captured off live-scan device
- Rotation and distortion
Public Datasets

NIST Special Database 27 and 27a

- 258 latent cases
- Includes rolled mate
- Included minutiae points validated by latent examiners
- ANSI/NIST formatted records
- 500ppi (SD27) and 1000ppi (SD27a)
Public Datasets

NIST Special Database 29 and 30

- 216 subjects (SD29) and 36 subjects (SD30) with two instances
- Rolled/Ten finger and plain impression (4-4-1-1)
- Scanned from inked fingerprint cards
- WSQ (SD29) and lossless (SD30) compression
- ANSI/NIST formatted records
- Fingerprint cards can be reconstructed
- 757 (SD29) and 316 (SD30) fingerprint images were used in SD4
Sample Images

SD4

SD[9, 10, 14, 29, 30]

SD[29, 30]

SD[29, 30]
Sample Images

SD24

SD27
Dataset Quality

- Mostly scanned fingerprint cards
- Markings on the cards and images
- No true live-scan
- SD4 is digital video
Dataset Distribution

- Deceased Subject
- CDROM (Small Fee ~$90) / Online Samples
- Compression - Lossless and Wavelet Scalar Quantization (WSQ)
- Image Format Issues – IHEAD - PNG
NISTIG: Public vs. Sequestered

- **Public**
  - Can distribute
  - Smaller sample sizes (hundreds/thousands)
  - Less storage capacity required
  - Older data (deceased subject)

- **Sequestered**
  - Can’t distribute
  - Larger sample sizes (millions)
  - Increased storage capacity required
  - Operational data
Dataset Consolidation

- Ground truth errors
- Controlled capture vs. operational
- Small vs. Large sample size
- Hashed/Anonymous identification impacts cross dataset consolidations
Fingerprint “Flipping”

Finger Positions Swapped

<table>
<thead>
<tr>
<th>Finger Positions</th>
<th>Swapped</th>
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<tbody>
<tr>
<td>1</td>
<td>6</td>
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<tr>
<td>2</td>
<td>7</td>
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<td>13</td>
<td>14</td>
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</tbody>
</table>
Fingerprint “Flipping”

Right Slap

Left Slap
NISTIG Evaluation Model

• Public Data
  • Development - Participant hardware
  • Validation – Participant and NIST hardware

• Sequestered Data
  • Large Scale Evaluation - NIST owned hardware
  • Results – Published in report cards and public reports.
Large Scale Evaluations

• **Proprietary Fingerprint Templates**
  - One-to-One
  - Fingers – Left/Right Thumb, Index, Middle
  - Impression – Plain and Rolled
  - #Subjects - ~120K each for mates/nonmates

• **MINEX – Interoperable Template**
  - One-to-One
  - Fingers – Left/Right Index
  - Impression – Plain
  - #Subjects - ~125K each for mates/nonmates

• **Fingerprint Vendor Technology Evaluation**
  - One-to-Many
  - Fingers – All Ten
  - Impression – Rolled and Plain/Slap
  - #Subjects – 1.6M, 3M, and 5M
Biometrics Evaluations at NIST
biometrics.nist.gov/evaluations
Impact of Evaluations

PFT – Proprietary Fingerprint Templates
MINEX – Minutiae Exchange (Interoperable Templates)
ELFT – Latent Fingerprint
SlapSeg – Slap Fingerprint Segmentation
MBE – Still Image Face Recognition
IREX – Iris Exchange
FpVTE – Fingerprint Vendor Technology Evaluation
FRVT – Facial Recognition Vendor Test

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• Current measure of biometric technology performance on operational/sequestered data
  ▪ Valuable to sponsors:
    o Developing system procurement requirements
    o Provides guidance in “who’s real”

• Competition among developers
  ▪ Evaluate performance with operational data
  ▪ Innovation – speed vs. accuracy

• Advance biometric matching technologies

• Improve implementation’s adherence to standards and protocols