Evaluating the Performance of Biometric Algorithms

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Outline

- *Why NIST?*

- *Impact and Issues with Evaluations*

- *NIST Evaluation Process*

- *Datasets*

- *NIST Evaluations*

- *Future Plans*

Why NIST Performs Biometric Evaluations

- *Mandates:*
    - *Patriot Act (PL 107-56)*
    - *Enhanced Border Security and VISA Entry Reform Act (PL 107-173)*
    - *Homeland Security Presidential Directive 12 (HSPD-12)*
    - *10-Print Transition: mandated by Homeland Security Council Deputies Committee*

- **Develop testing methods for evaluating biometrics performance**

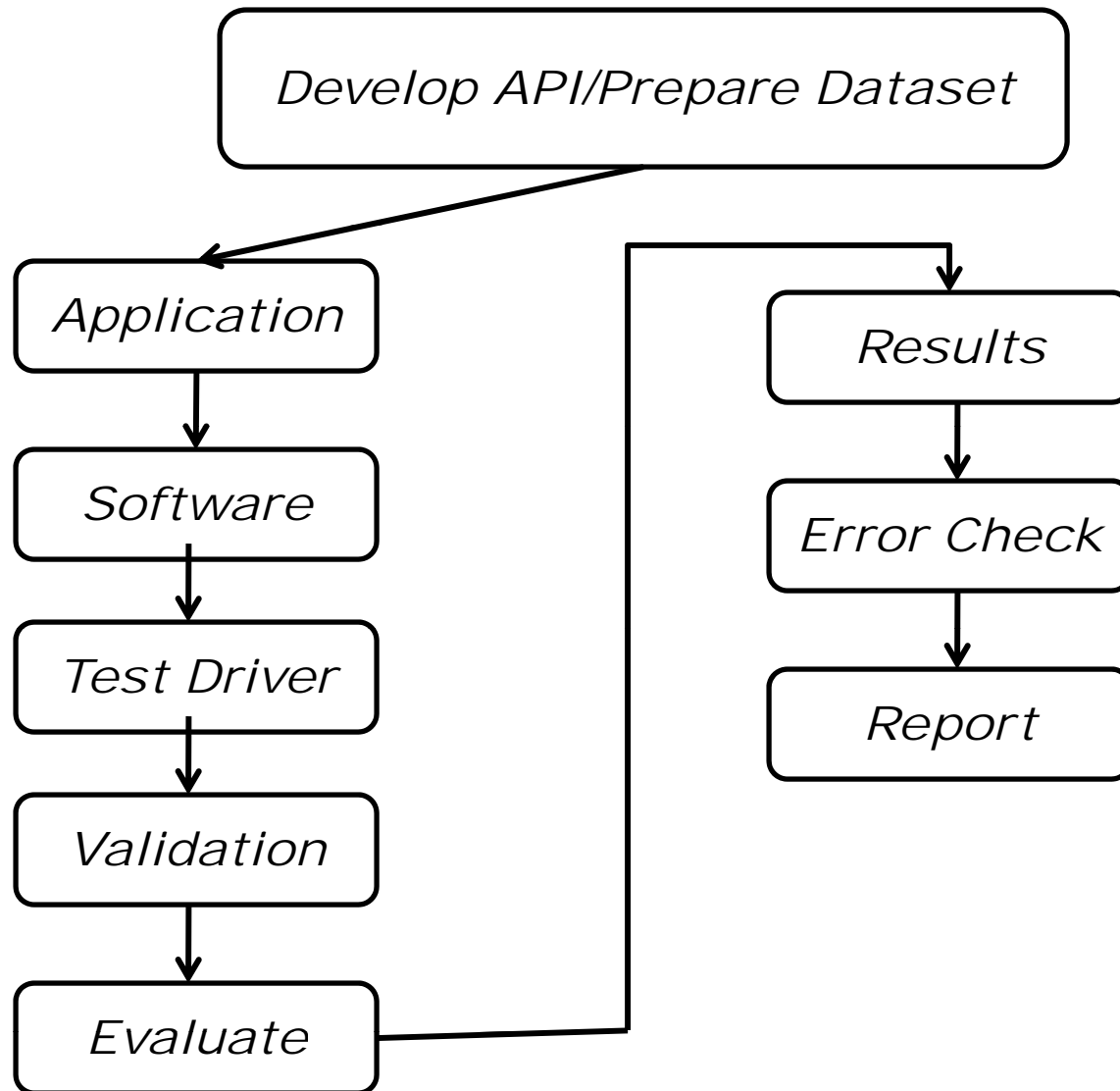- **Advance biometric matching technologies**

- **Other Government Agencies**

Impact of Evaluations

- *Current measure of biometric technology performance on operational data.*

- *Algorithm developers can evaluate performance with operational datasets.*

- *Advance biometric matching technologies.*

- *Improve implementation's adherence to standards and protocols*

Issues with Performing Evaluations

- Baseline algorithms (bozorth) give ability to develop evaluation methods

- Developing API to meet evaluation needs

- Dataset sample size

- Dataset preparation and security

- Repeatable results

- Validation/Security of submitted SDK

- Interpretation of results

Evaluation Process

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│   Develop API/Prepare Dataset       │
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- Application
- Software
- Test Driver
- Validation
- Evaluate
- Results
- Error Check
- Report

Evaluation Process

- *API*
  - *Inputs/Outputs to interface with SDK*
  - *Consider "gaming" issues*
  - *Use existing standards when possible*
  - *Length of time to run evaluation*

- *Dataset Preparation*
  - *Consolidations*
  - *Sample selection – random, sample size, diversity of data*
  - *"True" imposter data*
  - *Data format*
  - *Length of time to run evaluation*

Evaluation Process

- *Software Validation*
    - *Repeatable – why not?*
    - *Resolve issues of non compliance*
    - *Estimate length of time to run evaluation*

- *Evaluation*
    - *Managing across multiple systems – enrollment and matching stages*
    - *Unexpected exits*
    - *System maintenance shutdowns*
    - *Length of time to run evaluation*

- *Confidence in results*
    - *What to report*
    - *Statistical significance*
    - *Error check "outliers"*

Public Datasets
Algorithm Development & SDK Validation
biometrics.nist.gov/databases

- *Fingerprint*
  - *NIST Special Databases – 4, 9, 10, 14, 24, 29, 30*

- *Face*
  - *NIST Special Database 18*
  - *ColorFERET*

- *Iris*
  - *ICE dataset*
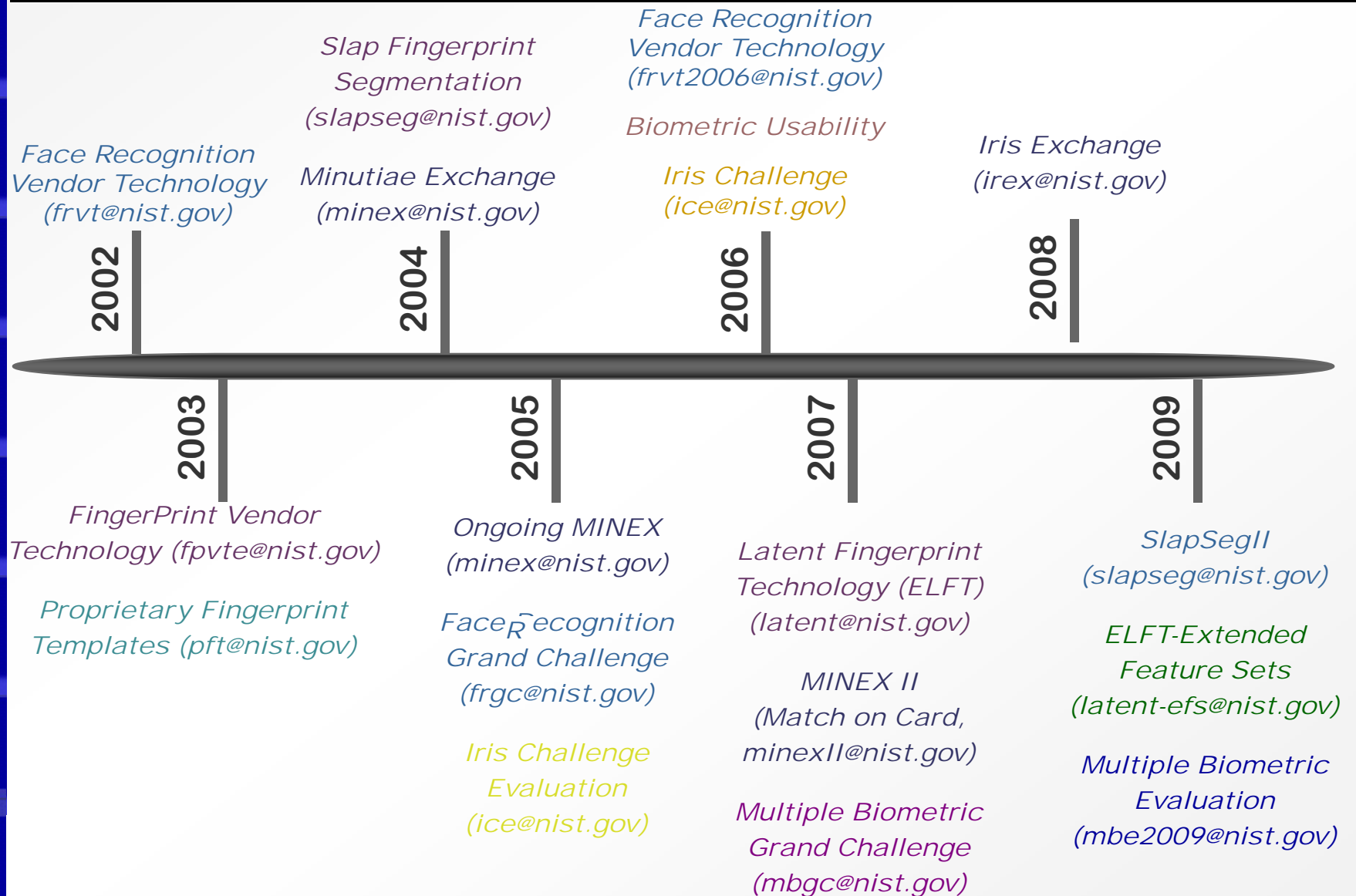
Sequestered Datasets
Used for Evaluations

- *Fingerprint , Face, and Iris*
  - *Operational Datasets from sponsoring agency*
  - *Large number of subjects (100,000 – 6,000,000)*
  - *Multiple Instances*
  - *Meta-data for results analysis*

Biometrics Evaluations at NIST

biometrics.nist.gov/evaluations

Slap Fingerprint Segmentation (slapseg@nist.gov)

Face Recognition Vendor Technology (frvt2006@nist.gov)

Biometric Usability

Face Recognition Vendor Technology (frvt@nist.gov)

Minutiae Exchange (minex@nist.gov)

Iris Challenge (ice@nist.gov)

Iris Exchange (irex@nist.gov)

2002

2004

2006

2008

2003

2005

2007

2009

FingerPrint Vendor Technology (fpvte@nist.gov)

Proprietary Fingerprint Templates (pft@nist.gov)

Ongoing MINEX (minex@nist.gov)

Face Recognition Grand Challenge (frgc@nist.gov)

Iris Challenge Evaluation (ice@nist.gov)

Latent Fingerprint Technology (ELFT) (latent@nist.gov)

MINEX II (Match on Card, minexII@nist.gov)

Multiple Biometric Grand Challenge (mbgc@nist.gov)

SlapSegII (slapseg@nist.gov)

ELFT-Extended Feature Sets (latent-efs@nist.gov)

Multiple Biometric Evaluation (mbe2009@nist.gov)

Large Scale Evaluations

- **SAN Storage for large datasets (240TB)**

- **High end computing**
  - **32 blades (4x4) with 192GB memory**
  - **24 blades (2x4) with 48GB memory**
  - **80 blades (2x2) with 16GB memory**

  - **136 blades -> 336 CPU -> 1024 cores**

Evaluation of Latent Fingerprint Technologies-Extended Feature Set (ELFT-EFS)

- *Gallery feature space 8-12GB*

- *Current: 80 blades (2x2) 4GB memory, 70 GB local storage workspace*

- *Upgraded: 16GB memory to allow searching backgrounds 10K subjects with 10 rolled prints or slaps each.*

- *300GB local storage workspace*

- *OS upgrades to 64-bit Linux and windows.*

Large Scale Evaluations

- **Use larger sample sizes in existing 1-to-1 evaluations (PFT, MINEX, ...)**

- **Large scale biometric identification evaluations (1-to-many)**

- **Government needs for evaluations on large datasets**

- **Testing methods and APIs for large-scale evaluations**

Thank You

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biometrics.nist.gov/evaluations