

# **NIST FINGERPRINT EVALUATIONS**

**Biometric Consortium Conference**

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**[www.itl.nist.gov/iad/vip](http://www.itl.nist.gov/iad/vip)**

# Statutory Mandates

- USA Patriot Act (PL 107 - 56)
- Enhanced Border Security and Visa Entry Reform Act (PL 107 - 173)
- Develop and certify technology standards including appropriate **biometric identifiers**
  - Identification – Background check; Is this person in the database? “One-to-many matching”
  - Verification – Entry check; Is this person who (s)he claims to be? “One-to-one matching”
- NIST mandated to determine estimates of the accuracy of biometrics (including fingerprints)

# Annual Border Crossings

<b>Type of Port</b>	<b>Number of Ports</b>	<b>Number of Primary Inspections</b>
Sea	86	11,952,501
Air	155	79,598,681
Land	154	414,364,965
<b>Total</b>	<b>395</b>	<b>505,916,147</b>

# Fingerprint Data Sources

- Biometric accuracy determination requires use of large - scale databases for testing.
- Large realistic test samples of images have been obtained by NIST from existing government databases at the DHS, DOJ, DOS, LACSD, Ohio, and Texas.
- All tests performed at NIST using images – not templates
- Testing is being done with 50 million fingerprints.

# Fingerprint Evaluation Variables

- Source of image
  - live scan
    - single finger (flat or rolled)
    - Slap (up to four fingers)
  - acquired as either flat or rolled from scanning an inked fingerprint card
- Size of image
- Quality of image
- Sample size
- Algorithm used

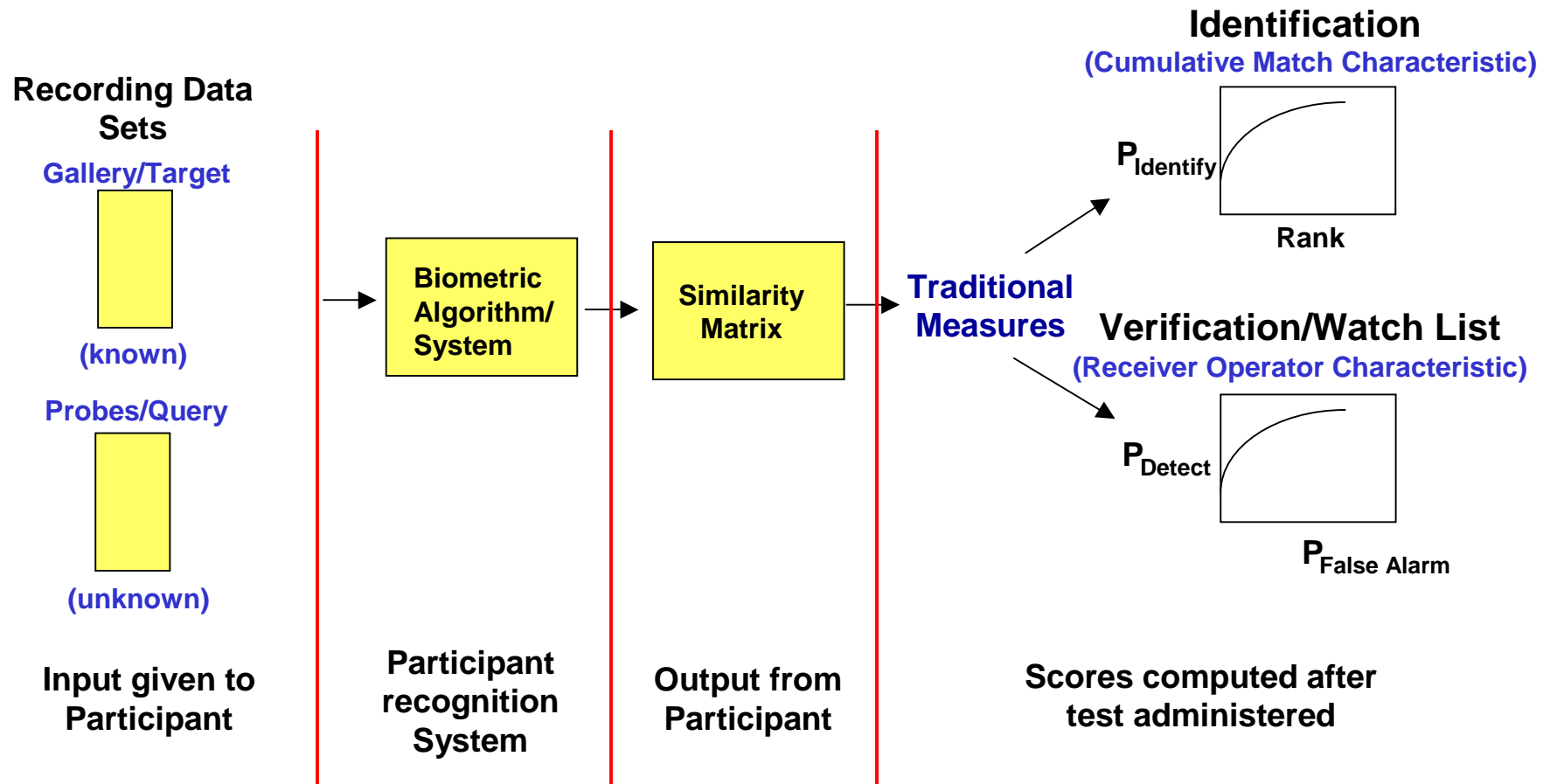
# NIST Fingerprint Evaluation Tools

- NIST 24 - Node Verification Test Bed (VTB)
  - Dual 1GB Memory
  - processor 1.8 GHz computer
  - 700 GB RAID box with 8 120 GB drives (1M tenprint records)
  - Software for segmentation, classifier, minutiae extraction, and fingerprint matcher
- Report available at: [www.itl.nist.gov/iad/vip](http://www.itl.nist.gov/iad/vip)

# NIST Fingerprint Evaluation Tools (continued)

- Algorithm Test Bed - ATB
  - Lockheed-Martin built for FBI IAFIS development
  - 1.2M background with 60K probe
  - Rolled-Rolled, Flat-Rolled, Probes 1-10 fingers
- Identification Test Bed - ITB
  - Cogent built for INS IDENT testing
  - 500K background with 60K probes
  - Rolled-Rolled, Flat-Rolled, Flat-Flat, Probes 1-10 fingers
- Fingerprint Vendor Technology Evaluation –FpVTE

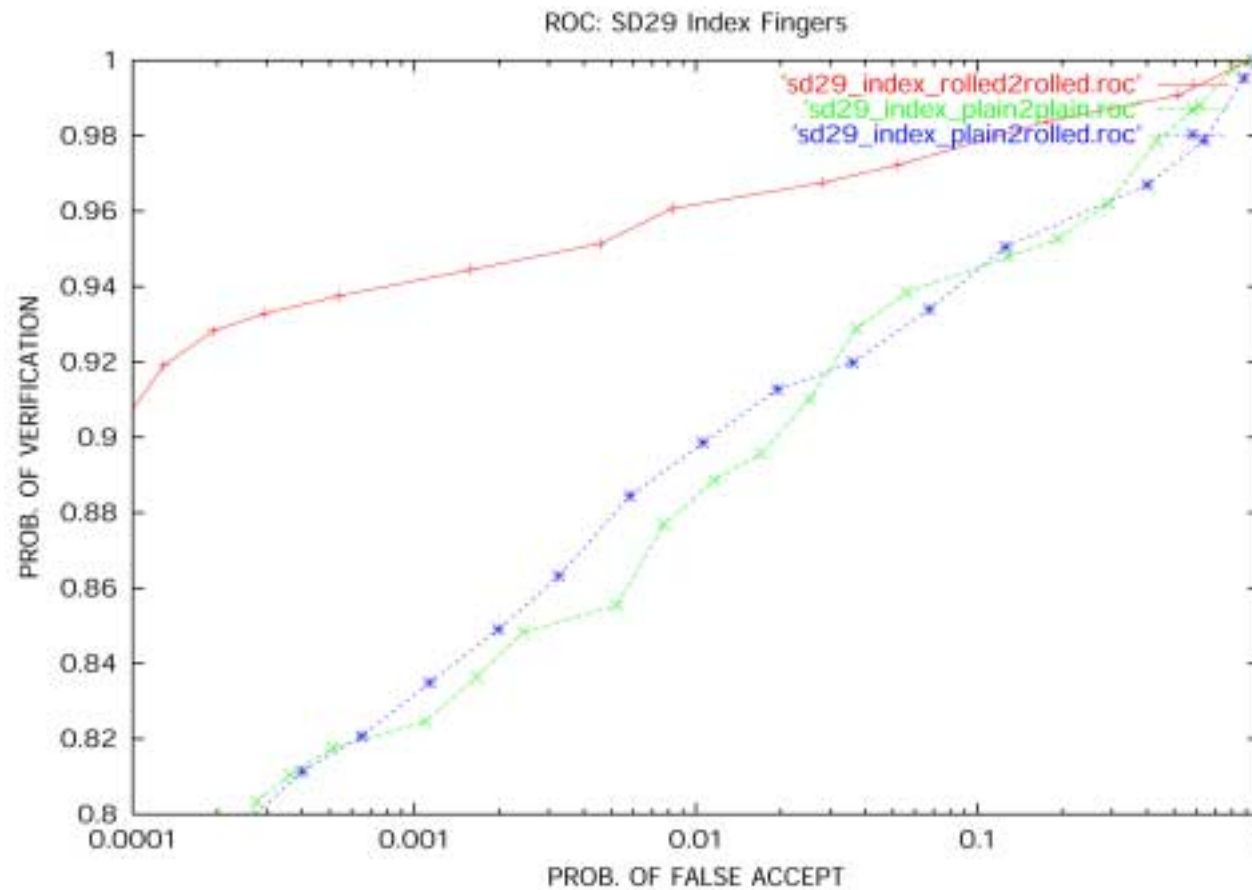
# Measuring Biometric Performance



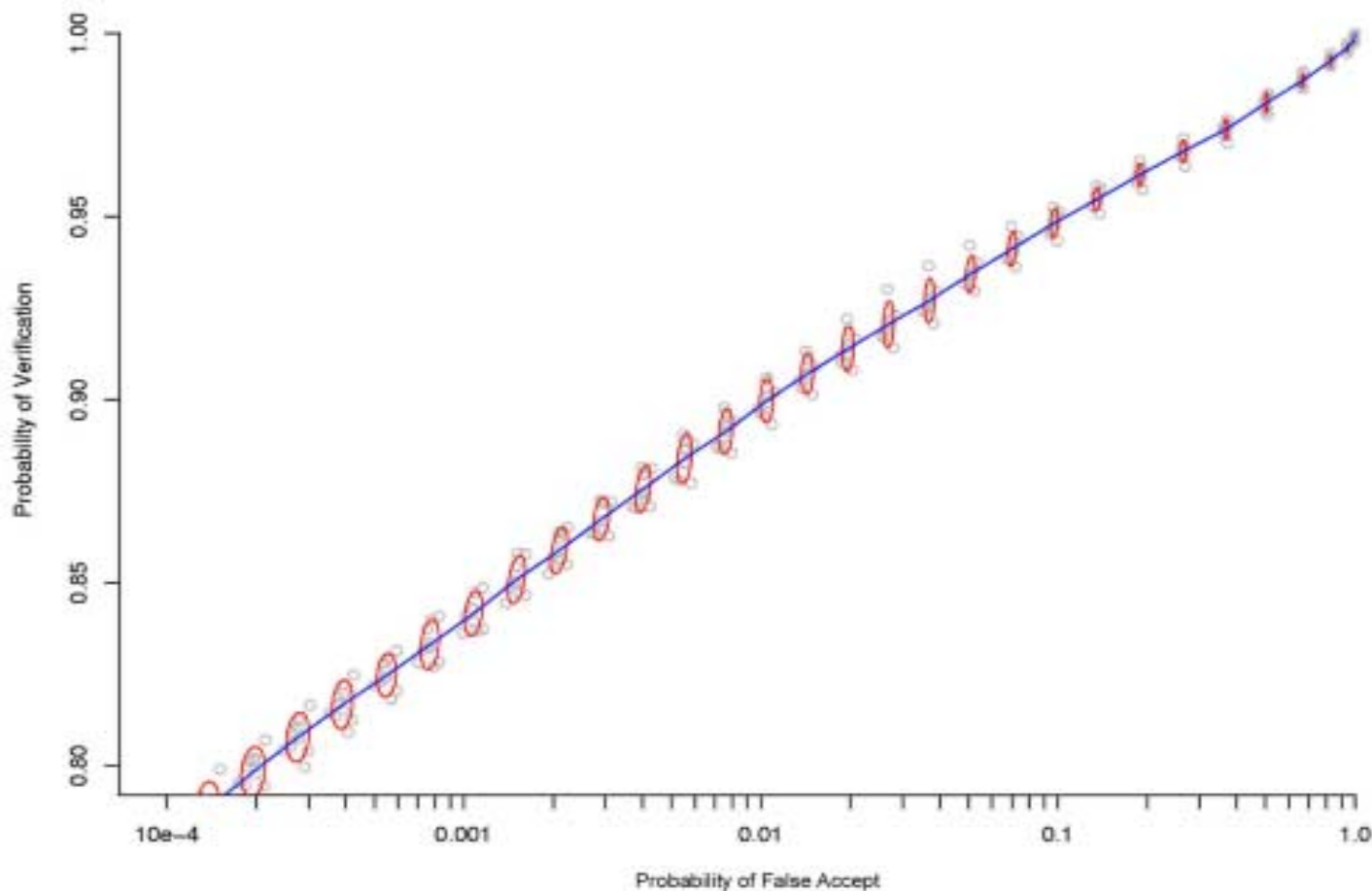
# SD 29 Fingerprint Verification

- Contains 2 tenprint cards for each of 216 subjects
- Each tenprint card contains ten rolled images and four plain images
- Tests were run using different fingers and different combinations of rolled and plain images
- The ROC plots the probability of a true verification as a function of the probability of a false accept
- How many “bad guys” are you willing to accept in order to maintain a low false reject rate

# SD 29 –Index Fingers Rolled and Plain

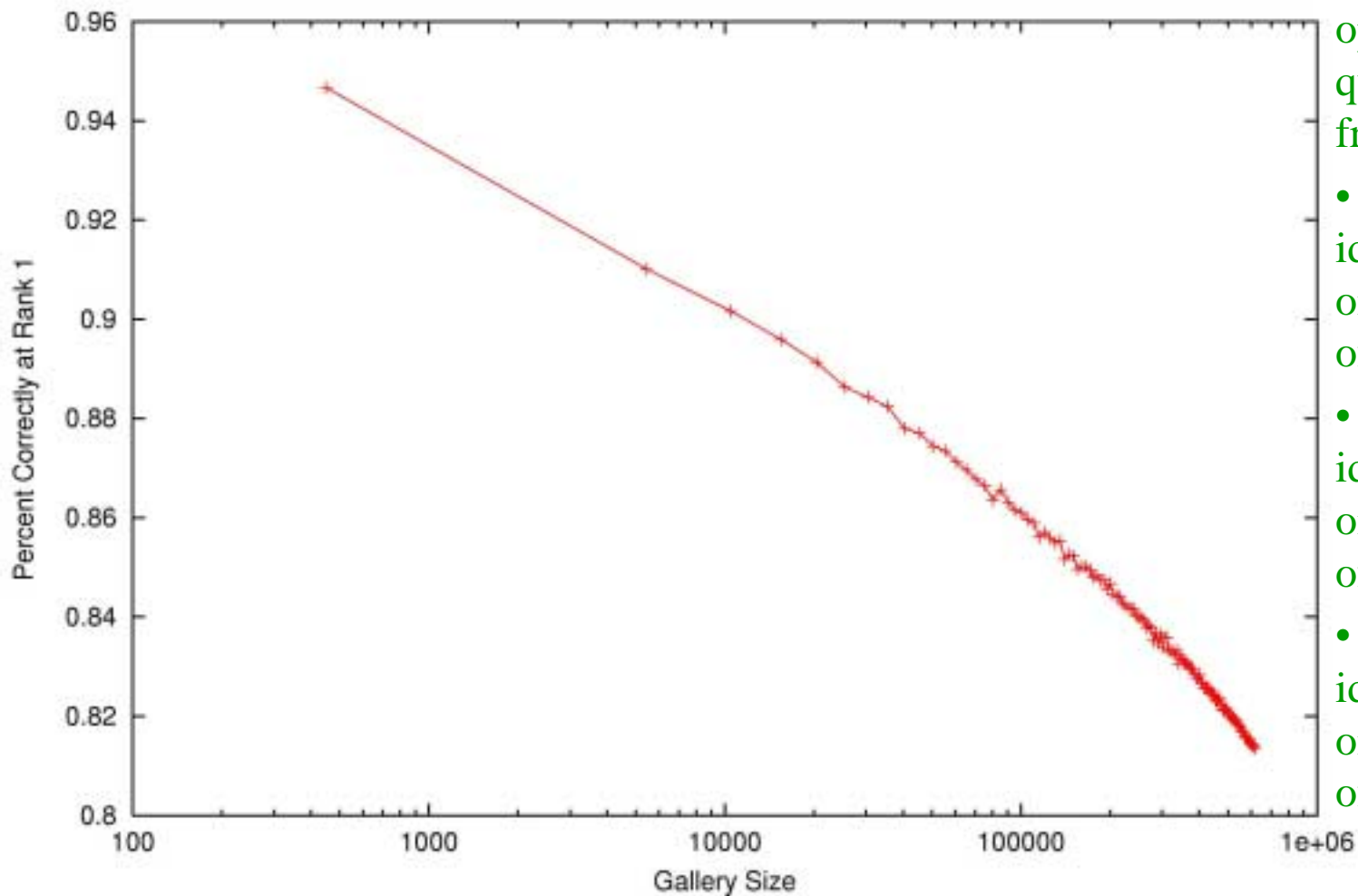


# ROC Plot for Fingerprint Verification



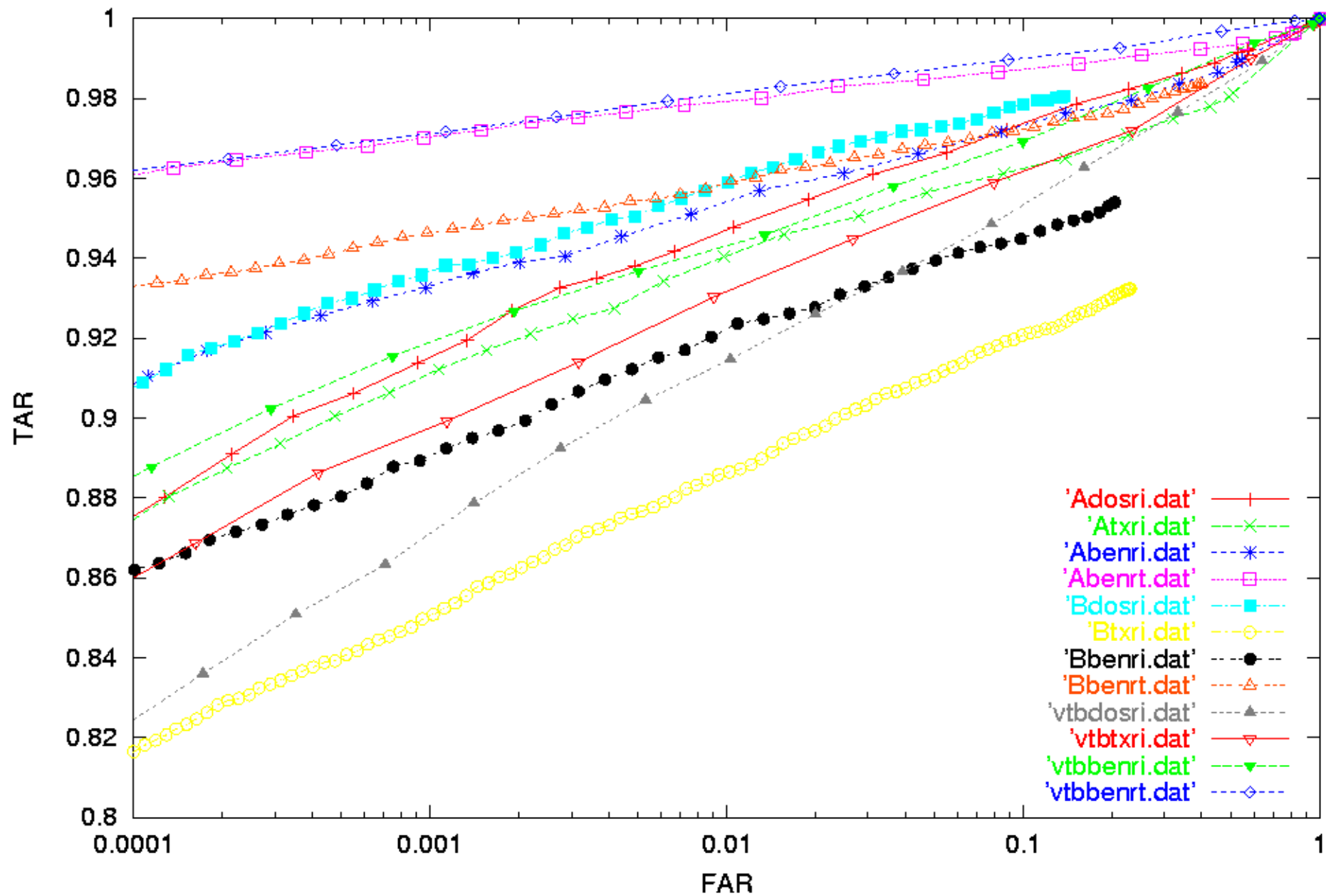
- 60,000 operational quality fingerprints from INS
- 90% probability of verification at 1% false accept
- 77% probability of verification at 0.01% false accept

# Fingerprint Identification: Probability of rank one detection for fingerprint vs gallery size



- 620,000 operational quality fingerprints from INS
- 96% probability of identification at rank one on gallery size of 500
- 90% probability of identification at rank one on gallery size of 10,000
- 86% probability of identification at rank one on gallery size of 100,000

ROC: SDK - DOS (P2P) - TX & BEN (P2R)



## TAR for 3 Algorithms & 4 Data Sets @ 1% FAR

Data Set	VTB - TAR	A - TAR	B -TAR
DOS	91.4%	94.5%	96%
TX	93%	94%	88.5%
BEN (RT)	98%	98%	96%
BEN (RI)	94%	95.5%	92%

# Fingerprint Vendor Technology Evaluation 2003

- FpVTE conducted by NIST for the Justice Management Division of DOJ
- FpVTE designed to provide performance measures for small to large - scale real world applications
- Serves as part of NIST's mandate of the Patriot Act to certify biometric technologies for possible use in the U.S. VISIT
- May form the basis for the design and acquisition of other large - scale fingerprint ID systems.

# FpVTE 2003

- Analysis & methodologies built on FRVT 2002
- Evaluations performed at NIST facility
- Preliminary testing required
- All data & results to be retained by NIST
- No anonymous submittals
- Test results will be publicly available in a NIST report after test conclusion
- Contains a public and private area website
  - ‘<http://FpVTE.nist.gov>’

# Types of Tests

- All image are 500 pixels per inch / 8 - bit grayscale
- SST (Small - Scale Test)
  - Matching accuracy for single finger livescan
  - Designed for those not able to do the MST
  - Completed within two weeks
  - Subset of MST
- MST (Medium - Scale Test)
  - Matching accuracy for single finger
  - Images from livescan flat or segmented slap image
  - Completed within two weeks

# LST (Large-Scale Test)

- Multiple tests
  - Combinations of fingers (1 - 10)
  - Different types (flat livescan, multi-finger slap livescan, rolled/flat ink)
  - Different levels of quality
- Tests must be completed within three weeks

# FpVTE 2003 Calendar

- July 15<sup>th</sup> Formal announcement
- August 12<sup>th</sup> Deadline for application
- August 19<sup>th</sup> System throughput questionnaire due
- September 17<sup>th</sup> Sample Similarity Matrices due
- September 19<sup>th</sup> Anonymous withdrawal date
- October 1<sup>st</sup> Testing begins
- November 21<sup>st</sup> Testing ends

# FpVTE Participant Summary

- Initially 27 vendors agreed to participate
  - 2 other vendors were too late
- Since then 8 have withdrawn
  - 5 were not a good match for business plans
- Currently 19 vendors scheduled to participate during periods from October 1<sup>st</sup> – November 21<sup>st</sup>
- Interested parties 32

# Summary of Participation By Test Type 9/17/03

- SST(only) - 1 vendor
- MST(only) - 6 vendors
- Multiple configurations 6 vendors
- Total configurations
  - SST 4-11
  - MST 23
  - LST 18
- MST&LST 14 configurations 10 vendors

## Email & Webpages

- [mccabe@nist.gov](mailto:mccabe@nist.gov)
- [www.itl.nist.gov/iad/vip](http://www.itl.nist.gov/iad/vip)
- [FpVTE.nist.gov](http://FpVTE.nist.gov)