# PATRIOT ACT
# ENHANCED BORDER SECURITY ACT

*CONFERENCE*
*PRESENTATIONS*

*August , 2002*

*R.M. McCABE*
*mccabe@nist.gov*

# STATUTORY MANDATE

- ***PL 107-56:*** The Attorney General and the Secretary of State jointly, through the National Institute of Standards and Technology (***NIST),*** ***….shall within 1 year after the date of the enactment of this section, develop and certify a technology standard (*****including appropriate biometric identifier standards*****)*** that can be used to verify the identity of persons applying for a US visa or such persons seeking to enter the US pursuant to a visa for the purposes of conducting background checks, confirming identity, and ensuring that a person has not received a visa under a different name…..

- ***PL 107-173:*** later than 180 days after the enactment of this Act, the Attorney General, the Secretary of State, and The National Institute of Standards and Technology (NIST), acting jointly, shall submit to the appropriate committees of Congress a comprehensive report assessing the actions that will be necessary… deployment of equipment and software necessary to allow biometric comparison and authentication of documents…Not later than October 26, 2004.

Not

# NIST OBJECTIVES

To support the provisions of the PL 107-56

- Determine the method to verify the identity of persons applying for a US visa
- Determine the method to verify that the person having a visa is the same person that was issued the visa
- ***Determine estimates of performance for finger & face***
- Develop and certify a technology standard based on one or more biometrics that have been determined to be highly accurate when used identification and verification

To support the provisions of PL 107-173

- Assisting the Attorney General and Secretary of State to establish document authentication standards for tamper resistant entry and exit documents to the US

# PATRIOT ACT
# BORDER SECURITY

- Identity background check for visa applicants
  - *Enhance the FBI's IAFIS*
  - *Develop new AFIS for INS*
  - *JMD will make final decision*
- Verification check for visa presenter
  - *Record one or more biometrics on memory chips*
  - *Use ANSI/NIST standard*
  - *Compare stored data to captured biometric*
- Finger & face biometrics
  - *2% of Population difficult to fingerprint*

# PERFORMANCE MEASUREMENT TOOLS

- Identification:  Algorithm Test Bed (ATB)
  - *Scaled down version of FBI's IAFIS at NIST (9/02)*
  - *Built by Lockheed Martin / Mitretek*
  - *Test combinations of rolled and plain finger images*
  - *Test use of less than ten finger images*
- Verification:  Verification Test Bed (VTB)
  - *Developed by the Image Processing Group*
- *FRVT 2002 - Facial Recognition Vendors Test*
- *Approximately 27 FTEs involved*

# VTB

- Currently a gigabit network of 6 nodes - expanding to 16 nodes
  - Increased communication speed
  - Improved security
- Each node consists of
  - Dual processor  1.8 GHz computer
  - 1 GB memory
  - 700 GB RAID box with 8  120 GB drives  (1M Tenprints)
  - Software for segmentation, classifier, minutiae extraction, and fingerprint matcher
- Large databases distributed between nodes
  - Test set put on all nodes
  - Exchange of large amounts of data accomplished by moving RAID box and plugging into another node

# TEST DATA SETS

- Biometric accuracy determination requires large scale testing
- Large operational test samples of images have been obtained from Texas State and Justice Departments
- Initial testing will be of face and fingerprint. No large sample of iris data is presently available.
- All tests conducted by NIST used images - templates were not used

# TENPRINT CARD
# (Rolled and Plain)

# FINGERPRINT DATA SETS

| NAME | SCAN TYPE | PLAIN | ROLL | TESTS | SIZE | QUALITY |
|---|---|---|---|---|---|---|
| SD 14 (V2) | Ink/live | | 10 | Roll:Roll | 2,700 Card Pairs | Medium |
| SD 24 | Live (DFR-90) | 10 | | Plain:Plain | 80 | Good |
| SD 29 | Ink | 10 | 10 | Roll:Roll<br>Plain:Plain<br>Plain:Roll | 216 Card Pairs | Medium |
| INS | Live | Index | | Plain:Plain | 1M Pairs | Operational |
| INS | Live | 10 | 10 | Plain:Roll | 100K Cards | Operational |
| TX | Ink/live | 10 | 10 | Plain:Roll | 1M Cards | Operational |
| ESD | Live | 10 | 10 | Plain:Roll | 3K Cards | Good |

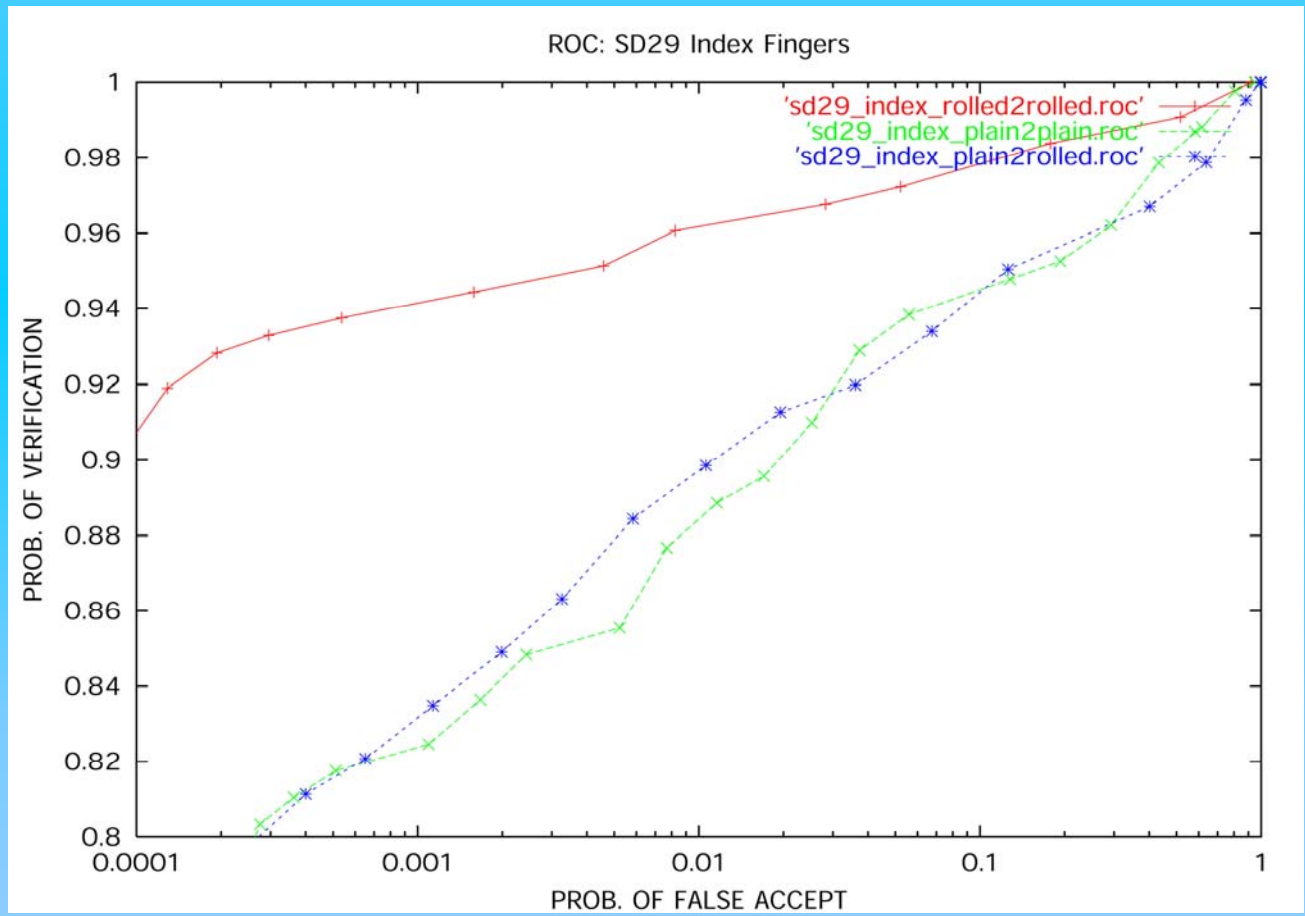
# VTB EXPERIMENTS

- *Single Finger Verification Tests*
  - Finger Position
  - Flat vs Rolled
- *Verification with Error Analysis*
  - 3000 subjects,  15 data set
  - classical statistical methods
- *Single Finger Identification*
  - 550 searches against 619,572 subjects
  - 85% to 55% detection - image quality

# SD 29 VERIFICATION TESTS

- Contains two tenprint cards for 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 COMPARISONS



# SD 29 RESULTS
# ROLLED & PLAIN COMPARISONS

**Probability of Verification for SD 29**
**With 1% False Accepts**

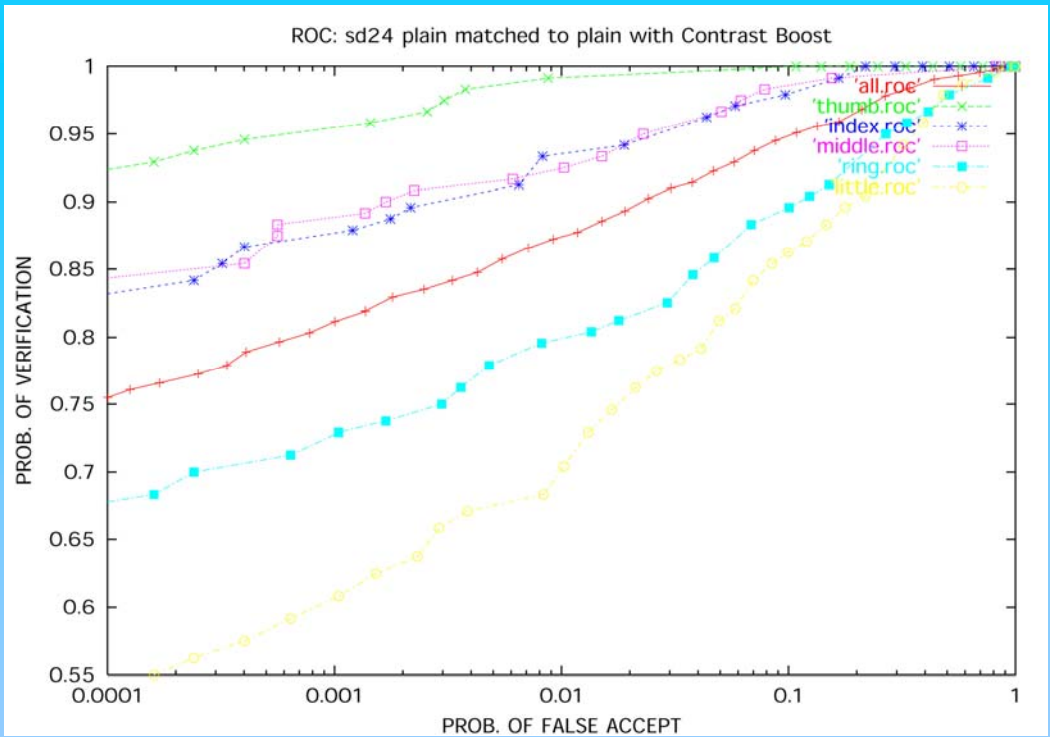
| | THUMBS | INDEX | MIDDLE | RING | LITTLE |
|---|---|---|---|---|---|
| Rolled:Rolled | 98.3% | 96.6% | 98.0% | 92.8% | 87.5% |
| Plain:Plain | 95.4% | 88.2% | 91.4% | 90.5% | 50.0% |
| Plain:Rolled | 93.6% | 90.6% | 90.6% | 88.0% | 50.0% |

**Probability of False Accept for SD 29**
**With 98% True Verifications**

| | THUMBS | INDEX | MIDDLE | RING | LITTLE |
|---|---|---|---|---|---|
| Rolled:Rolled | 0.4% | 10% | 1% | 22% | 50% |
| Plain:Plain | 18% | 42% | 39% | 60% | 88% |
| Plain:Rolled | 40% | 48% | 31% | 40% | 85% |

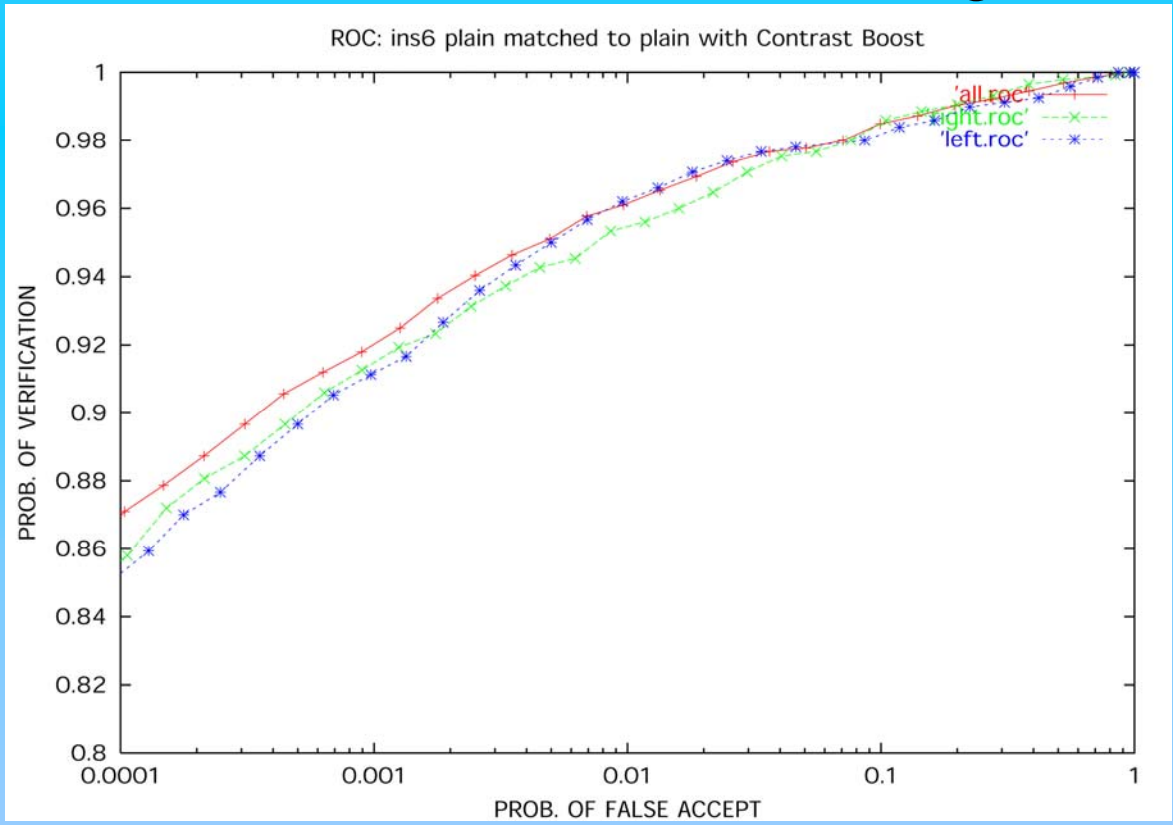
# SD 24 VERIFICATION TESTS

- Small live-scan database - 80 unique fingers
- Images captured in a NIST laboratory
- Subjects cooperative - best images available

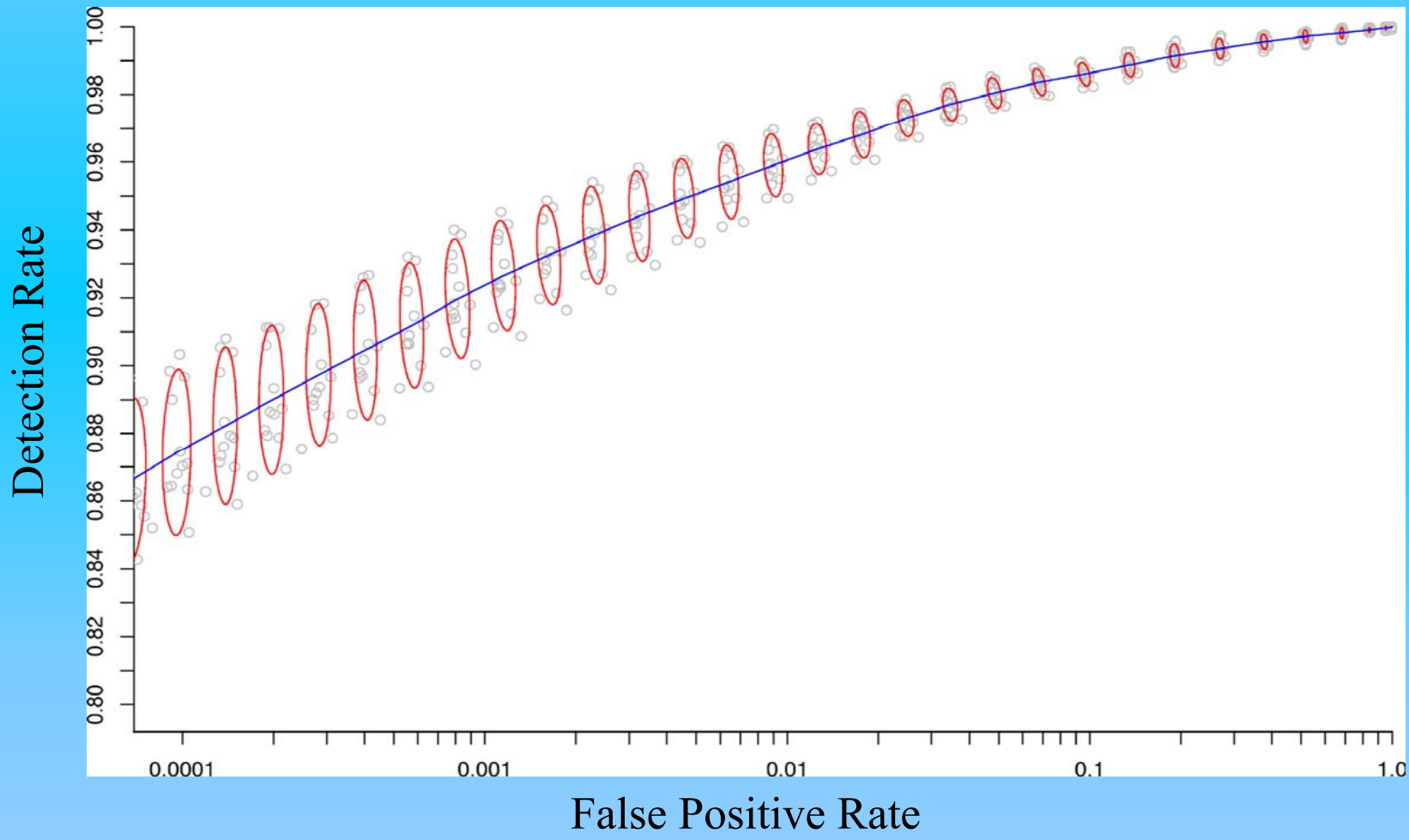


# INS INDEX FINGERS VERIFICATION TEST

- Processed in blocks of 3k fingers (45K processed)
- 95% True verification with 1% false accept
- Little difference between left and right index



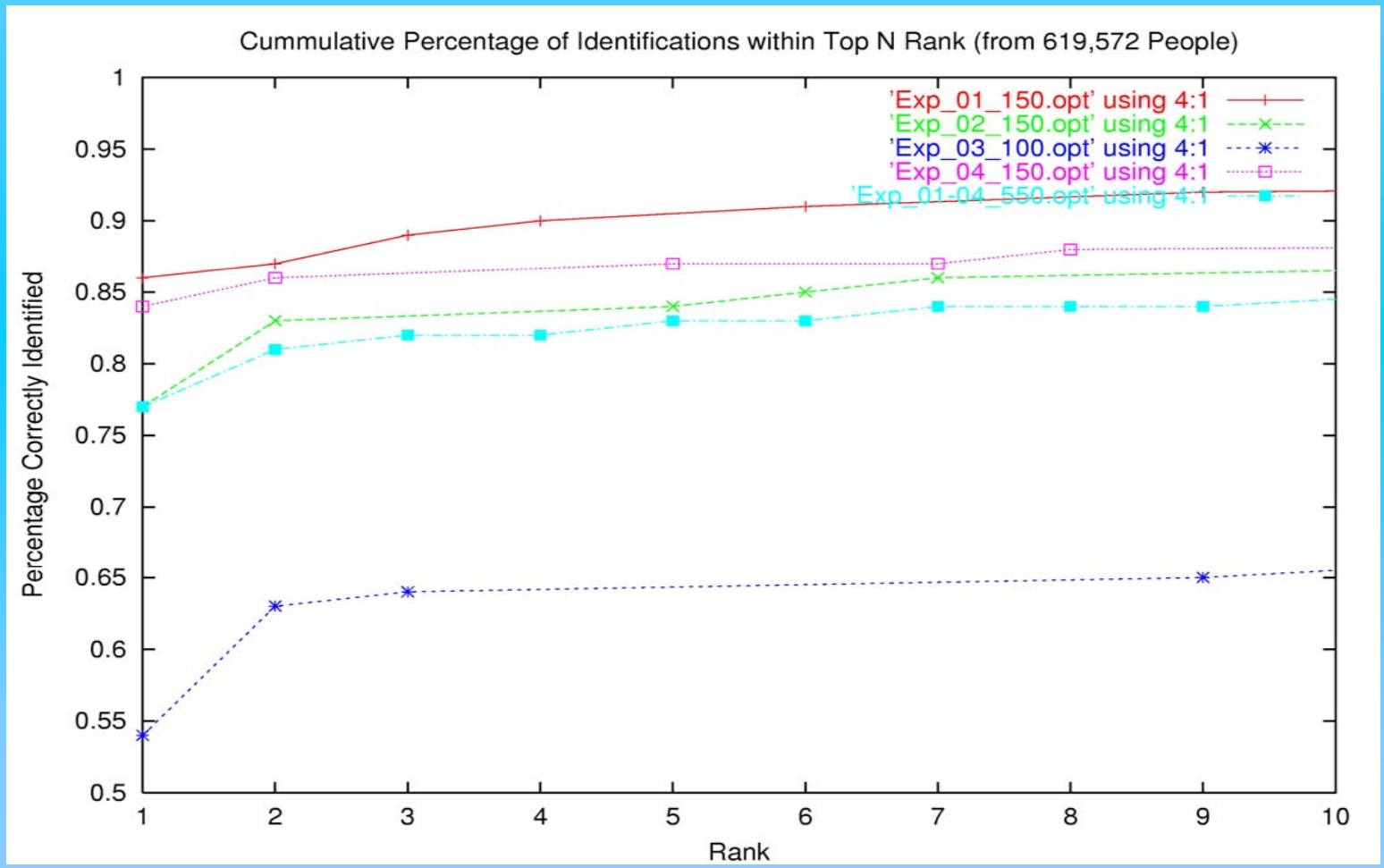
# VERIFICTION - ROC CONFIDENCE ELLIPSES



# INS TEST
# FULL GALLERY

- Probe set consisted of 550 finger images
- Each probe compared to 619,572 images
- Ran across four machines
- Test 1-2-4: 150 images in probe set
  - *77% - 86% ranked in first place*
- Test 3 : 100 images
  - *55% ranked in first place*

# SINGLE FINGER IDENTIFICATION



# FACE DATA SETS

| NAME | IMAGE TYPE | VIEWS | SIZE | QUALITY |
|---|---|---|---|---|
| INS FACE | JPEG | 2 | 625K Subjects<br>1.25M Images | Operational |
| STATE | JPEG | 1 or 2 | 6.3M Subjects<br>388K Pairs | Operational |
| HUMANID | JPEG | 20 | 859 Subjects | Controlled |
| FERET | TIFF | 12 | 1204 Subjects | Controlled |

# FACE RECOGNITION VENDOR TEST FRVT 2002

- FRVT 2002 in compliance with the US Patriot Act
- Accuracy for Airport Security & Entry/Exit from US
- Technology evaluation & progress made of commercially available and mature face recognition systems
- Sponsored by NIST, DARPA, DOJ, DOS, FBI
- Beginnings:
  - FERET 1993-96
  - FRVT 2000

# FRVT 2002
# TEST PLAN

- Two tests
- High Computational Intensity Test (HCinT)
  - Measure performance on very large data sets
  - 121,000 still images (15 Billion matches)
  - 30,000 individuals
- Medium Computational Intensity Test (MCinT)
  - Still image evaluation (7,500 images)
  - “Video style” evaluation
  - Aging & illumination tested
- *Original four tests*
  - Reduce do to large response

# FRVT 2002

- Fourteen Vendors participated
- Twelve companies did large scale test
- Test held in military base in VA
- Tests end August 8th
- Data analysis currently underway
- Initial report in October

# DEVELOPING STANDARDS

- Biometric Standards Committee M1 Formed 1/02
- ISO Committee WG 37 Forming
- Fingerprint Standard
  - *Minutiae*
  - *Pattern*
  - *Image*
- Facial Standard
  - *Image*
- Iris
  - *Image (Polar/Rectangular)*

# PRELIMINARY CONCLUSIONS

- Fingerprints provide higher accuracy than face
- INS data on index fingerprints provide 95% true verification with a 1% false accept (2% Tolerance)
- Previous face tests show 80% true verification with a 1% false accept rate
- Not all subjects can be easily fingerprinted
- The intelligence community often only has face data
- Dual biometrics including one or more fingerprints and a face on a chip may be required