

DHS Science & Technology:

Biometrics Collection and Matching

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Human Factors/Behavioral Sciences Division**

Science and Technology Directorate
Department of Homeland Security

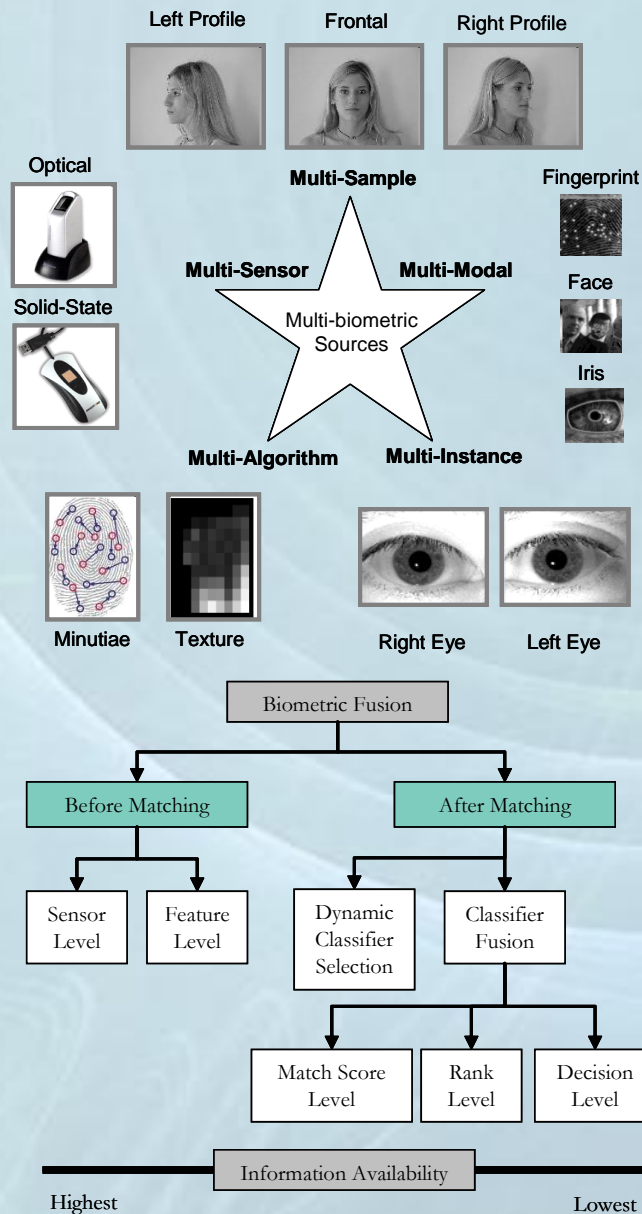
February 23, 2011



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Multibiometrics – Plenty of Challenges

Characteristic	Definition
1. Universality	Every individual accessing the application should possess the trait.
2. Uniqueness	The given trait should be sufficiently different across individuals comprising the population.
3. Permanence	The biometric trait of an individual should be sufficiently invariant over a period of time with respect to the matching algorithm. A trait that changes significantly over time is not a useful biometric.
4. Measurability	It should be possible to acquire and digitize the biometric trait using suitable devices that do not cause undue inconvenience to the individual. Furthermore, the acquired data should be amenable to processing in order to extract representative feature sets.
5. Performance	The recognition accuracy and the resources required to achieve that accuracy should meet the constraints imposed by the application.
6. Acceptability	Individuals in the target population that will use the application should be willing to present their biometric trait to the system.
7. Circumvention	This refers to the ease with which the trait of an individual can be imitated using artifacts (e.g. fake fingers), in the case of physical traits, and mimicry, in the case of behavioral traits.



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Multibiometrics – Plenty of Challenges

Robust and Novel Acquisition: Innovative methods of acquiring biometric information and novel or emerging biometric modalities.

Fusion Approaches:

Dynamic Decisional Fusion

Hierarchical Fusion

Quality Enhanced Fusion Schemes

Fusion Incorporating Meta/Ancillary Data

Hybrid Fusion

Sensor-Level Fusion

Rank-Level Fusion

Multi-Sensor Fusion



Multibiometrics – Plenty of Challenges

Observing the Biometric Menagerie: Careful examination of match score distributions as well as the observance and analysis of problematic subjects.

Biometric Capacity Analysis: Analysis of the theoretical system capacity of the template representation and the biometric variations observed during inter and intra-class comparisons.

Model Estimation/Update Schemes: Modeling update schemes to trigger the re-evaluation of system thresholds, re-estimation of relevant densities, or selection of different algorithms for classification.



Multibiometrics – Plenty of Challenges

Multi-Biometric Indexing Systems: Investigating the ability to index based on multiple biometric sources to minimize the penetration rate (percentage of the database searched) without adding additional errors due to incorrect indexing.

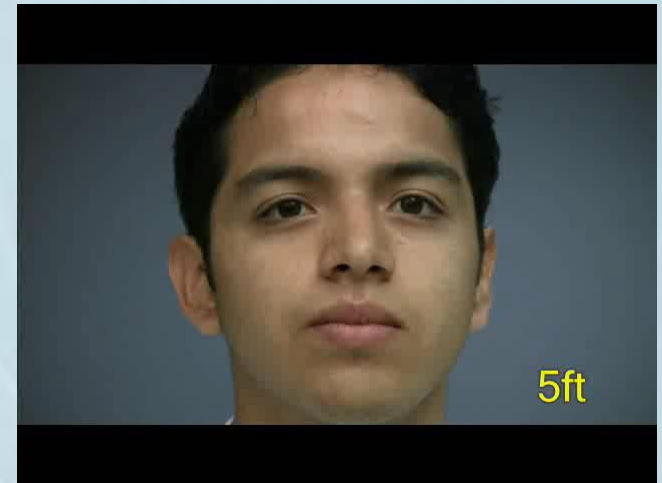
Addressing Multi-Biometric Vulnerabilities: Analysis of circumvention approaches for multibiometric identification, verification, and watchlist systems.



Multibiometric Resource – Free Data

Q-FIRE: Quality – Face & Iris Research Ensemble

- 200 person data collection varying quality factors of illumination, resolution, angle, focus and motion
- Used in NIST Iris Quality Calibration and Evaluation (IQCE) to test influence of quality metrics' on iris recognition accuracy
- Available to researchers:
Dr. Stephanie Schuckers, ECE
sschucke@clarkson.edu



Sample Q-FIRE Face Images



Sample Q-FIRE Iris Images



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Mobile Screening or Enrollment?

Goal: Obtain operational information on use and performance of state of the art mobile biometric and multi-modal biometric devices from law enforcement end-users

Objectives:

- Pilot next generation mobile biometric devices and obtain operational feedback from federal/state/local/tribal partners
- Demonstrate potential for discovering terrorist nexus through use of mobile devices in field, e.g. access to DHS/FBI databases
- Feedback to DHS S&T HFD for next BAA development

Current Device Performance

- Two print and thumb (rolled) –
10 print with larger devices
- Facial and Iris recognition/enrollment
- Latent print imaging
- Date, time and GPS stamp
- LAN connectivity
- On-board “watch lists”
with capability up to 100,000 records

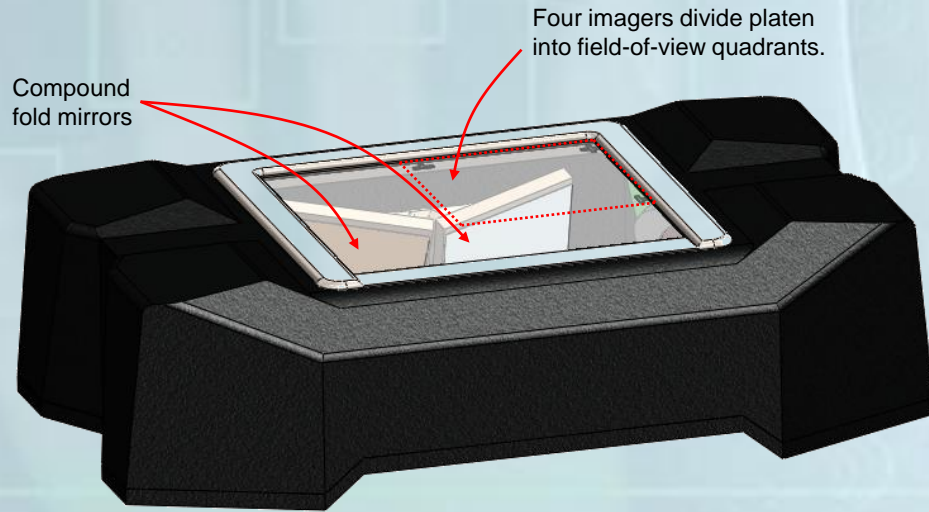


Participants and Deployments

- DHS/ICE Western Region
- DHS/ICE – Alamosa, CO
- WA State Criminal Justice Training Commission
- LAPD
- Pima County, AZ Sheriff
- Stockton, CA PD
- Marietta, GA PD
- St. Croix, WI Tribal Police
- Pinellas County, FL Sheriff
- Gwinnett County, GA Sheriff
- DeKalb Marshal, GA

Four Finger Slap Module

Southwest Research Institute



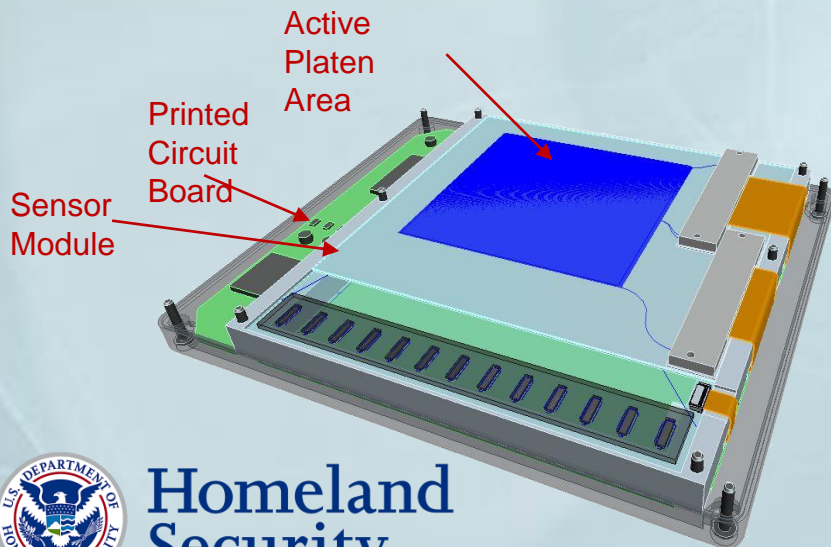
Specification	SwRI Proposed System
Resolution	500 ppi
Dimensions	7.9" x 5.1" x 2.1"
Weight	< 1.5 lbs
Capture area	3.2" x 3.0"
Usage	In/Outdoor, highly portable
Print Types	Single prints 4-Slap prints Rolled prints
Processing time	<5 sec per slap, <3 sec per flat, <8 sec per rolled
Architecture	Stand-alone or peripheral



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Four Finger Slap Module

L-1 Identity Solutions



Specification	L-1 Proposed System
Resolution	500 ppi
Dimensions	6" x 7.5" x 1"
Weight	< 2 lbs
Capture area	3.2" x 3.0"
Usage	In/Outdoor, highly portable
Print Types	Single prints 4-Slap prints
Processing time	10 sec for 4-4-2
Architecture	Stand-alone or peripheral




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DNA: Creating a New Biometric

Needs and Requirements Findings:

- On an average DAY in the life of USCIS:
 - 400 refugee applications processed worldwide
 - 40 persons in the US are granted asylum
 - 3700 applications to sponsor relatives and fiancées entry to the United States
 - 100 foreign born orphans are adopted by American parents
 - Fingerprints and photographs are taken of 11,000 applicants at the 133 Application Support Centers (ASC)
 - 135,000 national security background checks are conducted
 - 3,400 persons are granted citizenship (30 are serving in the US military)



A Day in the Life of USCIS

On an average day—

- More than a quarter million people visit our Web site.
- We answer 41,000 phone calls to our toll-free customer service line, and serve 12,000 customers at our 84 local offices.
- We ensure the employment eligibility of more than 80,000 new hires in the United States.
- We fingerprint and photograph 11,000 applicants at our 129 Application Support Centers.
- We conduct 135,000 national security background checks.
- We complete 30,000 applications for various immigration benefits.
- We process 200 refugee applications around the world, and grant asylum to 40 people already in the United States.
- We process 3,700 applications to sponsor relatives and fiancées. We also help American parents adopt 125 foreign born orphans.
- We process 2,300 petitions filed by employers to bring workers to the United States.
- We grant permanent residence to 3,400 people and issue 7,200 Permanent Resident Cards.
- We welcome 3,000 new citizens.
- Typically 30 of them are already serving their adopted country in the United States armed forces.

U.S. Citizenship and Immigration Services
www.uscis.gov 1 800 375 5283

M-488 (06-10)




U.S. DEPARTMENT OF
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DNA: Creating a New Biometric

Needs and Requirements Findings:


- DHS Needs to Verify Family Relationships
 - Kinship for Asylum and Refugee cases
 - Kinship for Adoptions
 - Kinship for Child Smuggling/Border Trafficking
- DHS to Identify Known Criminals
 - Immigration
 - DNA Criminal Check is not redundant to fingerprint check
 - CBP Border Violators & ICE Detainees
 - DOJ mandate to collect DNA from all detained persons
- DHS also Needs DNA for Mass Casualty and Missing Persons Identification



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IR-688 (06/12)



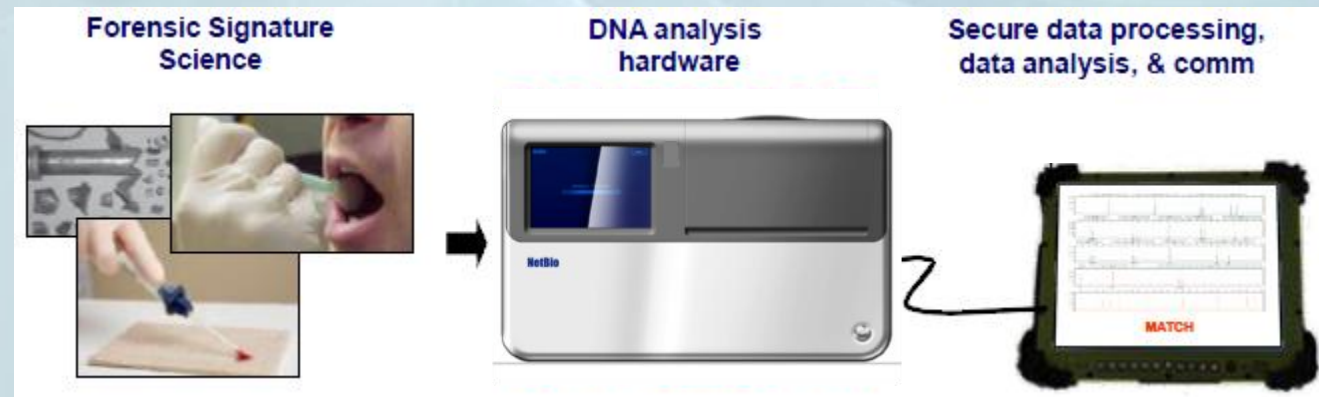
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DHS S&T Rapid-DNA Screening

“Accelerated Nuclear DNA Equipment”

Jointly funded DoD, DOJ, DHS Project

- Conduct 18 month R&D effort to develop prototype system
- Initial desktop-size, automated system with low-volume unit cost of \$275K available 6 months after prototype
- Current manual processing steps automated and integrated into a desktop-size device
- Delivery of Prototype in 18 months

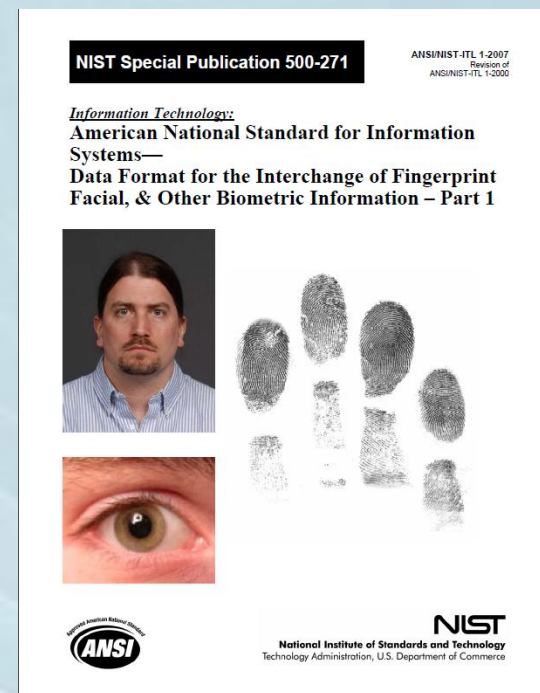


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Rapid-DNA Data Sharing Standards

ANSI/NIST-Information Technology Laboratory (ITL)

- First published in 1986
 - exchange of fingerprint information
- Updated in 2007 and 2008
 - Iris exchange
 - Conformance to other standards - XML
 - Updated facial and fingerprint specifications
- 2011 update underway
 - Adds a DNA and Kinship record in addition to other significant changes
 - Meeting next week (March 1-3) at NIST



http://www.nist.gov/itl/iad/ig/ansi_standard.cfm

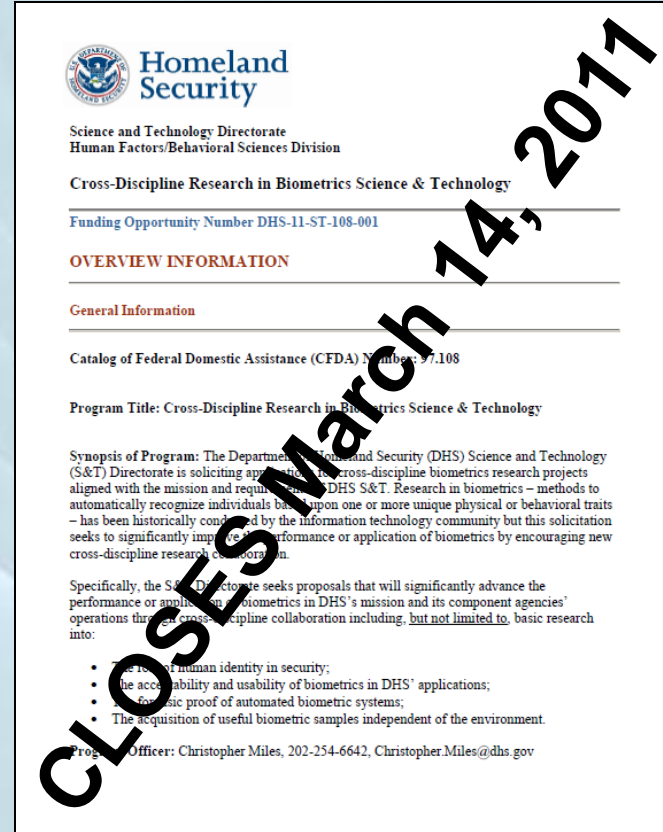



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Cross-Discipline Challenges

Cross-Discipline Research in Biometrics Science & Technology

- Funding Opportunity Number: DHS-11-ST-108-001 at www.Grants.gov
- Encourages cross-discipline biometrics research projects aligned with DHS mission and requirements
- Substantial participation must be shown by two or more scientific disciplines.
- Domestic & foreign accredited institutions of higher education (domestic must take the lead)



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Science and Technology Directorate
Human Factors/Behavioral Sciences Division

Cross-Discipline Research in Biometrics Science & Technology

Funding Opportunity Number DHS-11-ST-108-001

OVERVIEW INFORMATION

General Information

Catalog of Federal Domestic Assistance (CFDA) Number: 97.108

Program Title: Cross-Discipline Research in Biometrics Science & Technology

Synopsis of Program: The Department of Homeland Security (DHS) Science and Technology (S&T) Directorate is soliciting applications for cross-discipline biometrics research projects aligned with the mission and requirements of DHS S&T. Research in biometrics – methods to automatically recognize individuals based upon one or more unique physical or behavioral traits – has been historically conducted by the information technology community but this solicitation seeks to significantly improve the performance or application of biometrics by encouraging new cross-discipline research collaborations.

Specifically, the S&T Directorate seeks proposals that will significantly advance the performance or application of biometrics in DHS's mission and its component agencies' operations through cross-discipline collaboration including, but not limited to, basic research into:

- The role of human identity in security;
- The accessibility and usability of biometrics in DHS' applications;
- The forensic proof of automated biometric systems;
- The acquisition of useful biometric samples independent of the environment.

Program Officer: Christopher Miles, 202-254-6642, Christopher.Miles@dhs.gov



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Cross-Discipline Challenges

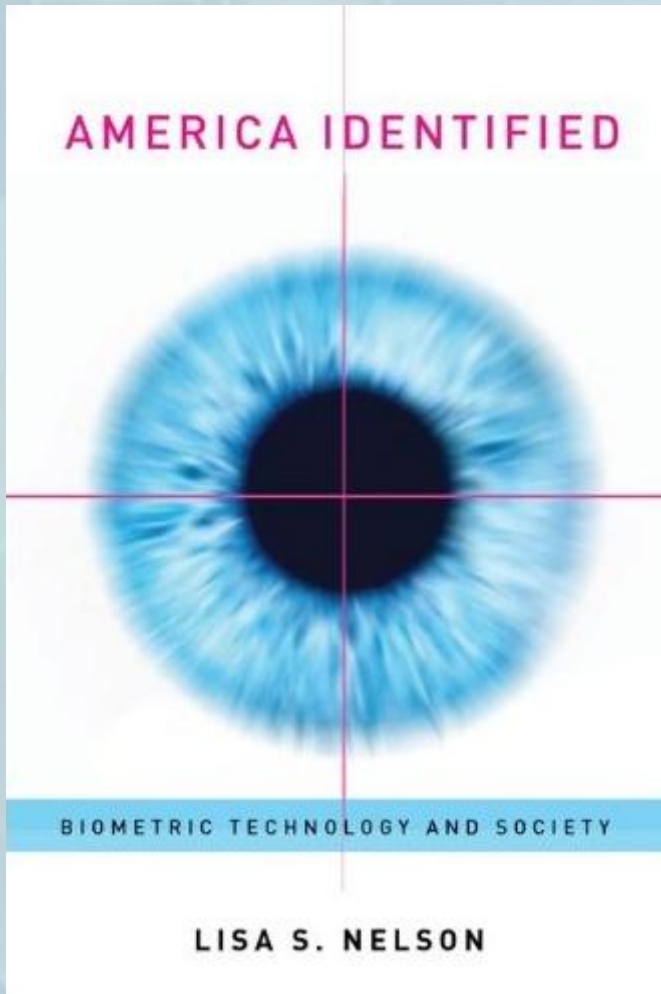
Cross-Discipline Research in Biometrics Science & Technology

- The role of human identity in security
 - combining biometrics and cryptography
- Acceptability and usability of biometrics in DHS' apps.
 - combining biometrics with mathematics, cognitive psychology, industrial design and/or behavioral sciences
- Forensic proof of automated biometric systems
 - combining biometrics and forensic or medical sciences
- Acquisition of useful biometric samples independent of the environment
 - combining biometrics with complimentary imaging disciplines
- Other cross-discipline topics that significantly enhance biometrics science and technology



Acceptability and Usability

America Identified: Biometric Technology and Society



- Provides an overview of the societal perception of identification technologies and biometrics
- Addresses privacy, anonymity, trust, paternalism and the impact of 09/11
- Results of surveys and discussion panels support a clear federal role for biometric security solutions
- Published by MIT Press in December 2010

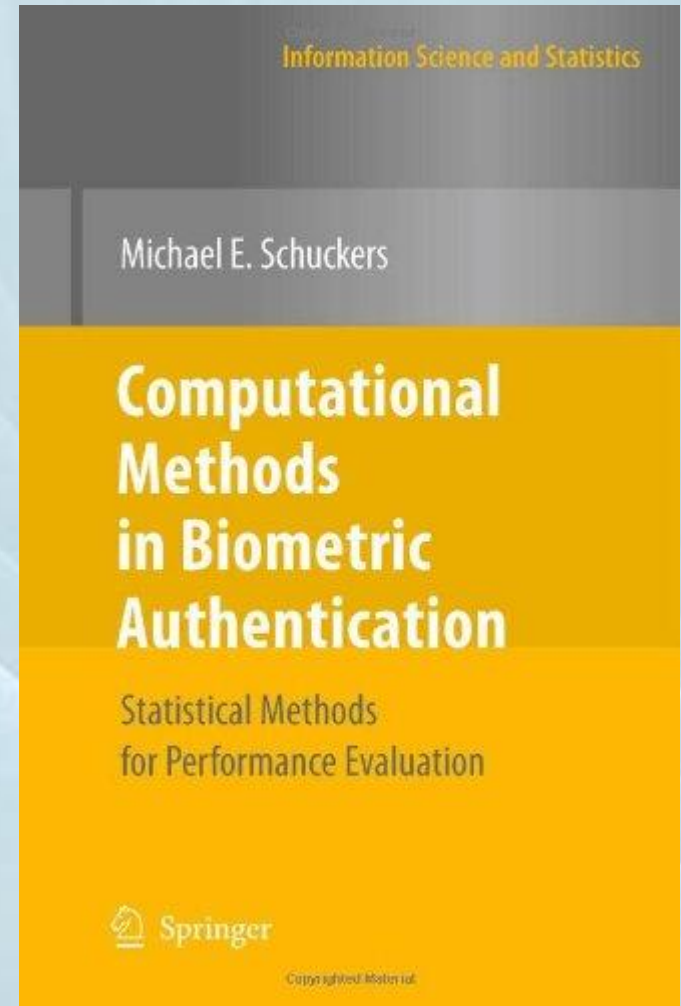


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Acceptability and Usability

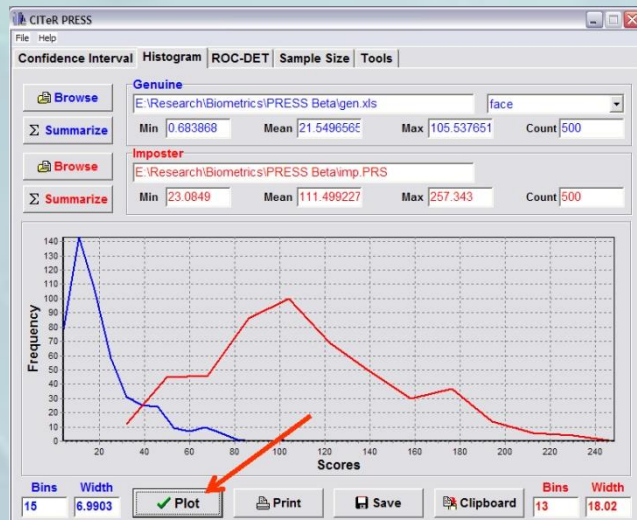
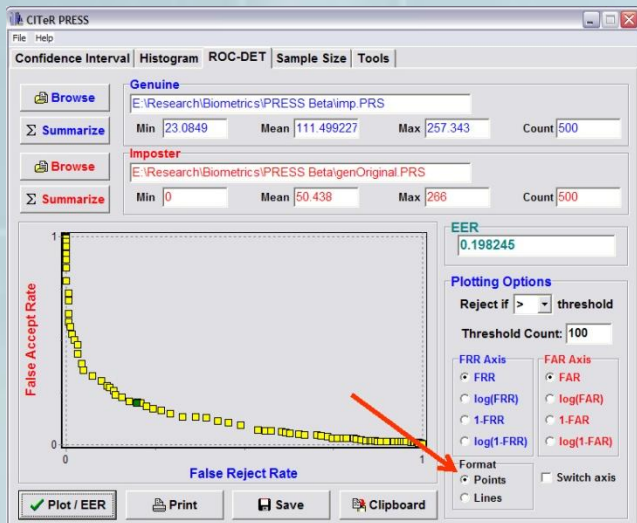
Computation Methods in Biometric Authentication

- Statistical methods for biometric performance metrics including: false non-match rate, false match rate, failure to enroll, failure to acquire and the receiver operating characteristic curve
- Allows for the comparison of two or more of these metrics
- More than 120 examples
- Published by Springer, 2010



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Acceptability and Usability



PRESS v.2: Program for Rate Estimation and Statistical Summaries

- Software Tool to implement the methods in Computational Methods in Biometric Authentication
- Confidence intervals, genuine vs. imposter histograms, EER calculations and ROC curves
- Tool for determining sample sizes needed for data collections
- Available as Freeware at: <http://myslu.stlawu.edu/~msch/biometrics/book/software.html>



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Indispensable Resources

www.Biometrics.gov

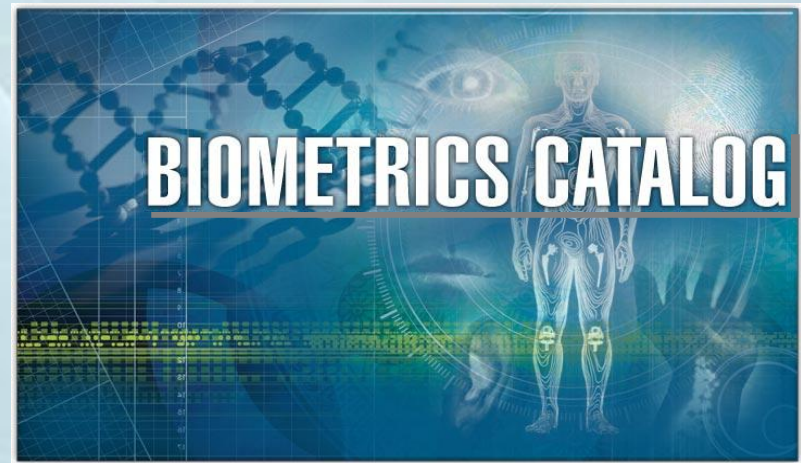
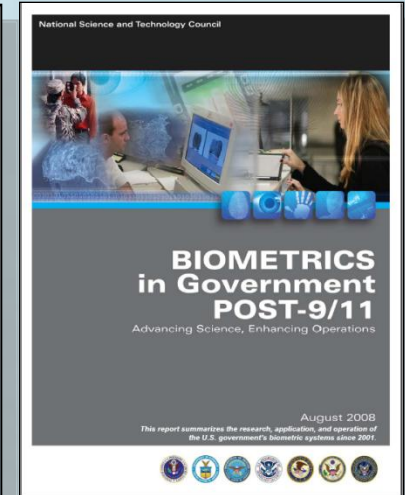
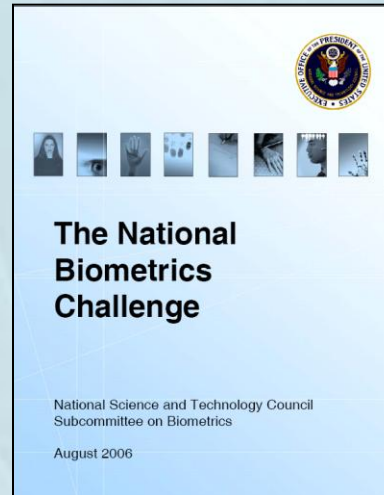
Central source on Federal government biometrics-related activities

www.BiometricsCatalog.org

U.S. Government-sponsored database of public information about biometric technologies kept current by its users, who add information as it becomes available – Free to use and update

www.Biometrics.org

Biometrics Consortium web site with free discussion bulletin board and annual conference news



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Biometrics.gov



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