



CCMTA / CCATM Board of Directors, December 8th, 2003 Ottawa, Ontario

Biometric Technology

An introduction to the science
(as applied to DL/ID requirements)

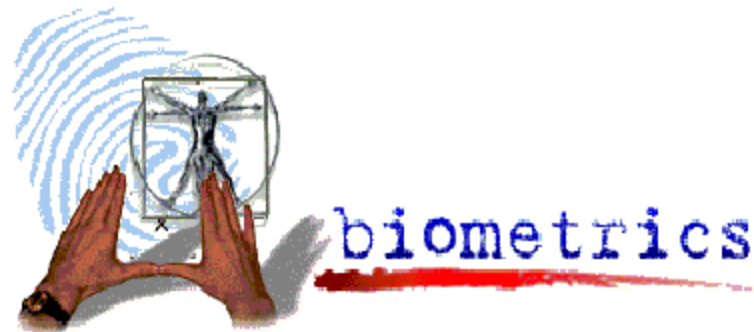
Ian Williams
Principal



www.idsysgroup.com

Biometrics: Defined

Automatically recognizing a person using distinguishing traits. (A narrow definition)



Biometric technologies are defined as automated methods of identifying or verifying the identity of a living person based on physiological or behavioral characteristics.

Recently, this was modified to include chemical attributes (DNA) Nov. 2003



Biometric Market Today

16+ Technologies

540+ Biometric Vendors



***What are they
and
How do you choose?***

1997 – Snap Shot

8 Technologies

20+ Biometric Vendors



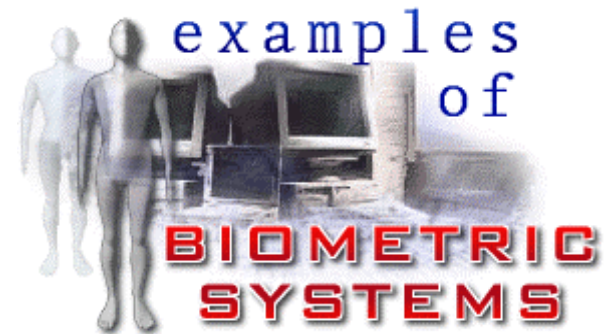
***What are they
and
How do you choose?***



Biometric Technology 101

Biometric Technologies

- Iris Recognition
- Finger Scans
- Hand Geometry
- Facial Recognition
- Signature Dynamics
- Voice Dynamics
- Retinal Scan
- Vascular Patterns



Behavioral is difficult to enroll for DL/ID
Physical biometrics apply to DL/ID

Biometric Terminology

Verification 1:1

Measurement of an identity against a single claimed identity

Answers the question:

Am I who I claim to be?

Identification 1:N (many)

Measurement of a single identity against multiple identities

Answers the question:

Who am I?

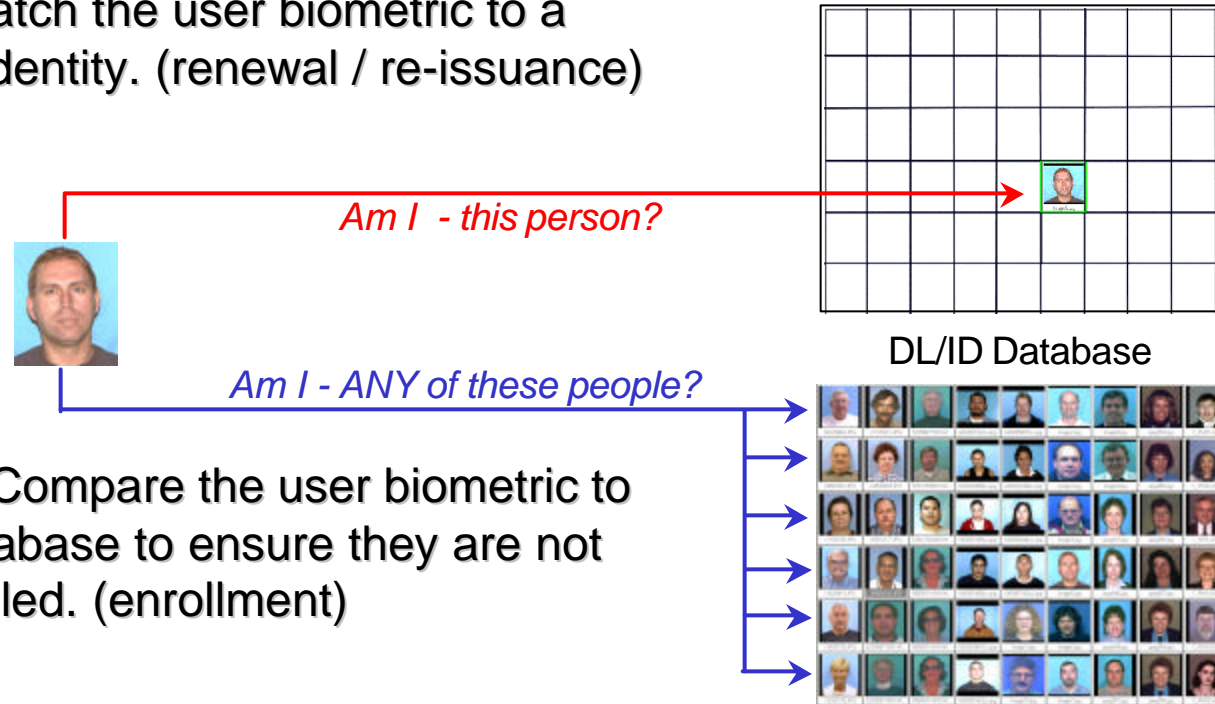
1D1R (*1 driver – 1 record*):

Requires identification, to ensure that I am enrolled only once.



DL/ID Biometric Uses

Verification – Match the user biometric to a single claimed identity. (renewal / re-issuance)



Identification – Compare the user biometric to all others in database to ensure they are not previously enrolled. (enrollment)

DL/ID require biometric(s) that can perform BOTH verification & identification



Iris Recognition

Issues/Obstacles

- Iris stable after adolescence
- Sole source worldwide
- Enrolment limitations
- No demonstrated large-scale ID

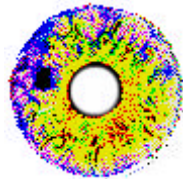


How it works

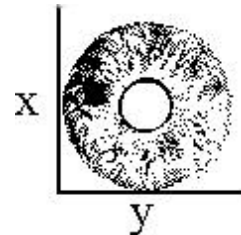
Video Capture



Pattern Extraction



Coordinate Creation



Iris Code Record

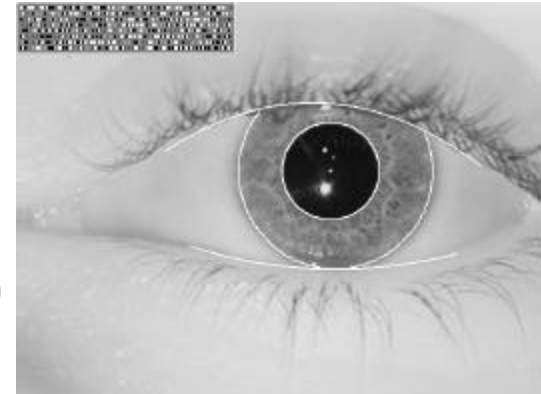
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1100001000101000001000101010100010  
0010001001000101010101000101010010  
0001010100001010101000101010001010  
01010101010100101010010001010100  
00010101010101010001010101010101  
0010101001010100010100100101010101
```



Iris Recognition

Features/Benefits

- Highest accuracy (1:N)
- Constant throughout adulthood
- No physical damage (picture not scan)
- Successful applications deployed



Iris sampling offers more reference coordinates than any other biometric. Mathematically, it therefore has a higher accuracy potential than any other biometric.

Iris recognition is suitable for both **Identification** & **Verification**



Iris Recognition Applications

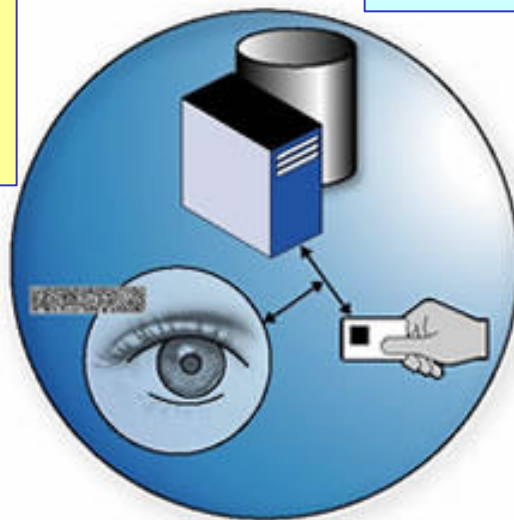


Financial Services

Ak Bank (Turkey)
Citibank (NY)
Dresdner Bank
(Germany)
Nationwide Building
Society (UK)
Takefuji Bank (Japan)

Computer Security

Hewlett Packard
KPN Telecom (The Netherlands)
U.S. House of Representatives, Legislative
Counsel (DC)



Government

CCRA CANpass – 2003
UK National ID Card – (2005)
US VISIT program (tentative)



Canada Customs & Revenue



Client: Canada Customs and Revenue (CCRA)

Application: Border Control – CAN-PASS.
Eight airports starting with Toronto and Vancouver in Q4 '02. Trials with U.S. at Ottawa and Montreal in 2003.

System Integrator: IBM Global Services

Background: “Iris is your passport.” CCRA will charge \$50 annual fee. Card based.

Number of users: 100,000 – largest public sector use of Iris thus far.



Finger Scan

Issues/Obstacles

- Intrusion perception
- Exemptions
- Compatibility (negative opinion)
- Capture device resolutions

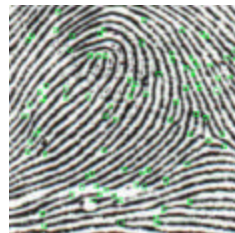


How it works

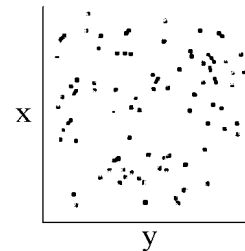
Image Capture



Minutiae Identification



Template Mapping



Record Formation

```
0111000101000101110100010100000100  
1100001000101000001000101010100010  
0010001001000101010101000101010010  
0001010100001010101000101010001010  
010101010101000101010001010100  
00010101010101010100010101010101  
00101010010101000101001001010101
```

Biometric Technology 101

Finger Scan

Features/Benefits

- High accuracy
- Reliable
- Most widely deployed
- Capture device variety
- Low cost devices *



* Not all finger scanners suitable for 1:N identification, due to low resolution

Finger Scanning is suitable for both **Identification** & **Verification**



Finger Scan Applications

Financial Services

Banking ATM
Internet Banking
Retail Transactions



Secure Access

Microsoft
Oracle
New York Stock Exchange
HP

DL/ID Cards

Arkansas – V
California
Colorado
Georgia
Hawaii
Texas
W. Virginia

Finger Scan



Smart Card



Social Services

Texas
Connecticut
New York
Toronto



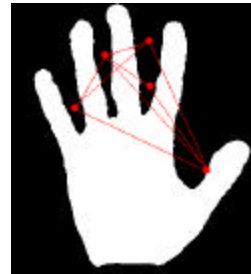
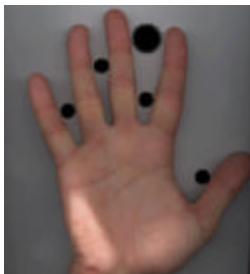
Hand Geometry

Issues/Obstacles

- Uniqueness
- Unsanitary (perception)
- FRR/FAR High
- Expensive scanner



How it works



Hand Code

43BFFFA60



Hand Geometry

Features/Benefits

- Reliable
- Non-intrusive
- Small record size (9 bits)
- Successful deployments



Hand Geometry is suitable for **Verification** only.
Hand Geometry is NOT suitable for **Identification**.



Hand Geometry Applications

Identification Cards

INSPass

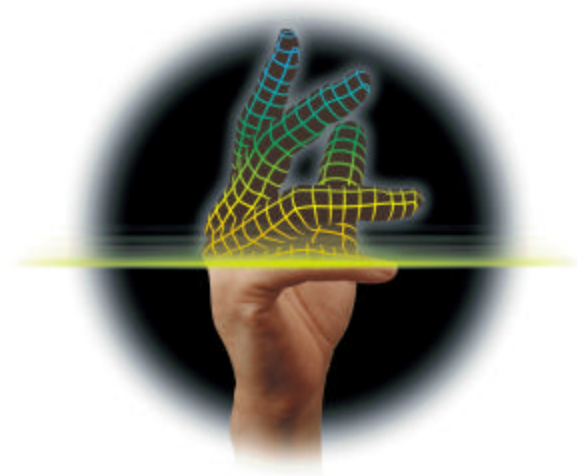
Secure Access

IBM

Exodus

Sandia National Labs

San Jose State University



Time & Attendance

Coca-Cola

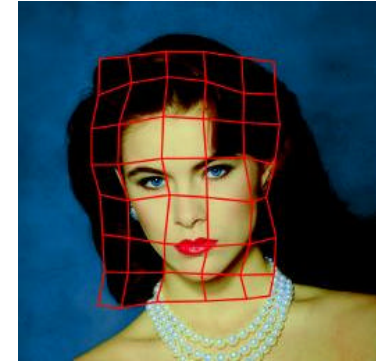
First Bank of Minnesota



Facial Recognition

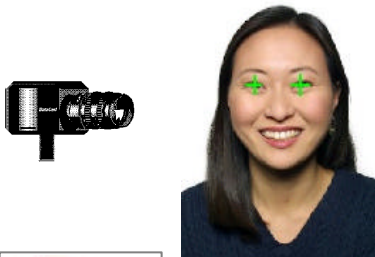
Issues/Obstacles

- FRVT 2002 – Low accuracy
- Eyewear issues (DL/ID)
- Vendor exaggerations
- No facial template standard

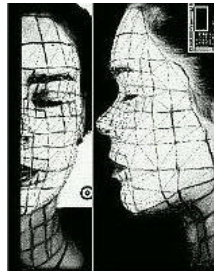


How it works (Geometric)

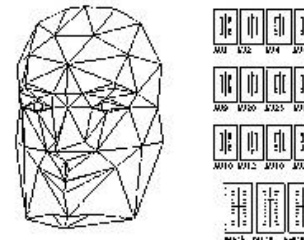
Photo taken / Index located



Nodal Points



Template created (numeric)



Other methods:

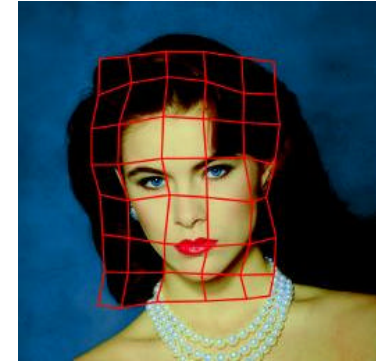
- Eigenface
- Feature analysis
- Neural network
- Automatic face processing
- Thermography
- 3-D Modeling

Biometric Technology 101

Facial Recognition

Features/Benefits

- DL/ID – Low hardware cost
- DL/ID – Image dB exists*
- Existing process
- Controlled enrollment



* Images in databases may not be suitable for automatic template extraction.

Facial recognition is suitable for **Verification**.

Facial recognition is a useful tool for assisting **Identification**.



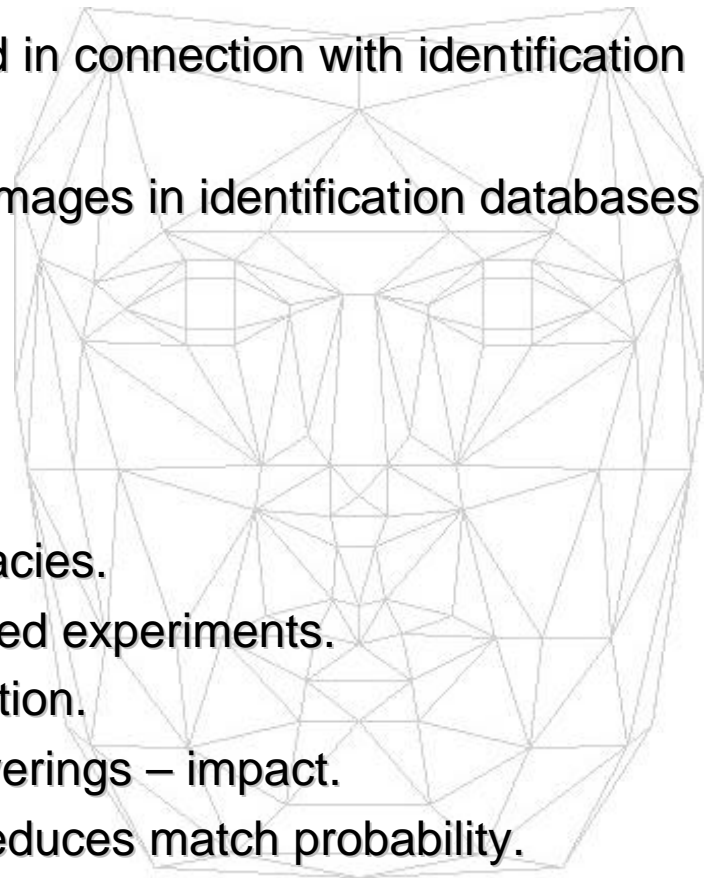
Facial Recognition Continued

Positive

- Facial images are almost always captured in connection with identification documents.
- There are estimated to be 2 billion facial images in identification databases around the world.
- Innocuous in a DL/ID environment.

Negative

- FRVT 2002 indicates questionable accuracies.
- Recent pilots at airports concluded as failed experiments.
- Disguises can easily defeat facial recognition.
- Lighting, age, glasses, and head/face coverings – impact.
- Aging of comparison images drastically reduces match probability.



Facial Recognition Apps



Identification Cards

West Virginia Driver License
Illinois Driver License
Alberta Operators Licence
Mexican Voter Registration

Surveillance

CD Airport Paris
West Ham Football London
Airport – Logan & Tampa *

Secure Access

IBM (Thinkpads)
DeutscheBank
MGM Casino
Sydney Airport *

*Systems withdrawn



Canadian Biometric Initiatives

Alberta Operator Licence - 2003

Facial recognition – Initially used as a verification check, may attempt to utilize as an identification application.

CANpass - 2002

Iris recognition – Used to allow rapid cross border travel. Uses an optical card to store Iris template.

CATSA - 2004

Finger scanning - New program to be deployed 2004 to secure airport areas using biometric smart card and gate access.

Canadian Passport – 2004

Facial recognition - (+ secondary biometric?)
Smart chip to be added to passport and to include biometric templates (ICAO standard).

Toronto Welfare 1997-1999

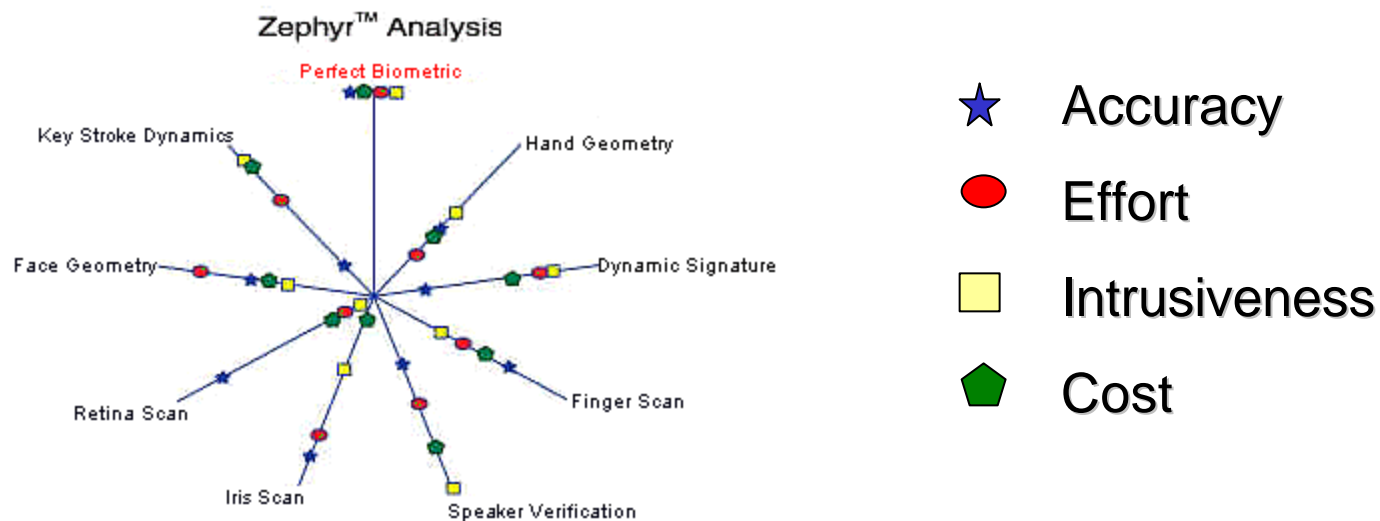
Finger scanning – Designed to prevent multiple enrollment of welfare recipients. Program abandoned in 1999.

CIC – National ID card 2003 - 2010

Undecided – current House of Commons debate whether to establish a new National Identity Biometric Card.



Choosing a Biometric Technology



4 important factors when choosing a biometric



Data Considerations

Technology	Template size (Bytes)
Iris Recognition	512
Finger Scan	200 - 512
Hand Geometry	9
Facial Recognition	88 - 1024

Machine Read Technology	Storage Capacity	Relative Cost
2-D Barcode	1800	Very Low
Magnetic Stripe	204	Low
Smart Chip	64k	High
Optical / Laser Card	4MB	Very High

Match your biometric technology needs with machine read needs, and consider the costs.



Storing a biometric in a Card

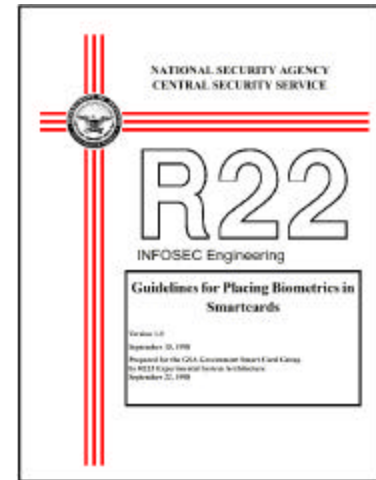
2-D Barcode



Employ internationally accepted, secure biometric standard formats.

No need to re-invent the wheel!

Smart Card



*** Biometric templates stored on cards MUST be secure from theft. ***

Avoid proprietary formats, that may force royalties and limit interoperability



“While the AAMVA standard describes a common way to record fingerprint minutiae, it still allows for including data in a vendor-specific format.” **

** Page 66 GAO-03-174 Biometrics for Border Security (May 2002)



Biometric Industry Trends

- Iris is the number one technology in accuracy
- Iris / finger can facilitate large 1:N search (**Identification**)
- Finger is biometric leader (market share)
- Facial is popular although losing credibility
- Compounded biometrics for accuracy (US VISIT; UK ID)
- **Verification** is publicly appealing (combats identity theft)
- Voluntary enrollment is increasing (“Opt-in”)
- Passports to contain biometric(s) next year (2004)



Practical Solutions

Higher Security

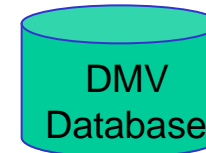
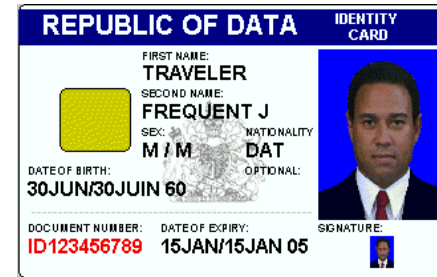
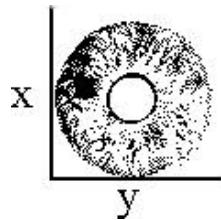
Iris Recognition



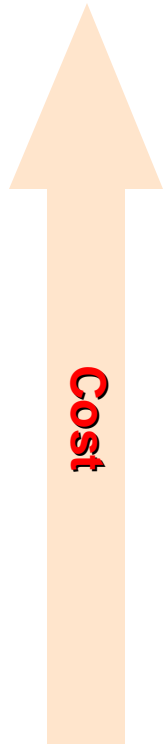
Finger Scan



Facial Recognition



Lower Security



Biometrics: Reality

Biometrics are a useful tool to improve the identification process.

Biometric searches may assist in identifying multiple similar/identical records.

Biometrics can ensure the verification of an individual to their own record.

- ❖ Every biometric technology can be duped
- ❖ No single biometric can enroll ALL applicants
 - ❖ No biometric can provide 100% accuracy
- ❖ Biometrics will not GUARANTEE multiple enrollee prevention
- ❖ Human intervention WILL be required to resolve probable matches



Get more info here:

www.idsysgroup.com

Follow links to Biometric Resource Centre

www.biometrics.org

US Government focal research site



Biometric Technology 101

Questions????

