Information Security
Identification and authentication

Advanced User Authentication I

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Agenda for this part of the course

Background

Statistics in user authentication

Biometric systems

Tokens

Agenda for lecture I within this part of the course

- Background
- Statistics in user authentication
- Biometric systems
- Tokens

Authentication
eID
ePassports
Biometrics in general
Statistics
Generic biometric system

Fumy, W. and Paeschke, M. Handbook of eID Security

A. Jain, A. Ross and K. Nandakumar, Chapters 1 in "Introduction to Biometrics"

User authentication/identification

Can in an IT system be achieved via

- What I know – passwords, PIN
- What I have – ID-cards, smart-card, token
- What I am/do – biometrics

Identification

Authentication

Human ID identification/authentication: Used when, where and why?

Forensics: Does a suspect match the features of a criminal

Banking/Financial services: Money only to its owners

Computer & IT Security: Access only to those authorised

Healthcare: Correct patient history (and billing)

Immigration: Blocking unwanted residents in spe

Law and Order: Punishing the correct person

Gatekeeper/Door Access Control: Access only if authorised

Telecommunication: Billing, trust base and privacy

Time and Attendance Logging: For future audit

Welfare: Only to valid beneficiaries

Consumer Products: Against unauthorised use, liability etc.

Biometric examples

SAS – Scandinavian Airline Systems: Fingerprints used to tie the person who checked in luggage to the person who passes the passenger gate.

OMX Group:To enter to most secret part of the company you have to authenticate yourself in an iris scan.

A school in Uddevalla, Sweden: To enter the dining area you needed to identify yourself with your fingerprint.

Disney World, SeaWorld and other amusement parks and entertainment centers: Fingerprints to tie tickets to their users

Fingerprint in third world applications

Authentication requirements

Can be presented only by the correct person

- Only the correct person knows the value
- Only the correct person can physically present the value

Has enough diversity to be unique enough

- Truly unique, can be used for identification
- Overlap very unlikely, can be used for authentication

eID: Electronic identity

Then: Manual ID control, e.g. in a bank or post office

Now: Transactions & communication online

Future: Internet of things

eID: Challenges

- New possibilities for criminal activity
  - Public administration, businesses and citizens act within digital networks
- Phishing
- Social engineering
- ID theft, Identity fraud
- Cyber attacks on personal data
- Spoofed websites
- Compromised log-in accounts

eID-threats and risks: Do I have to care?

- 2010: ID fraud survey
  - 5% US population victims of ID theft
  - 13% of ID fraud crimes by someone the victim knew
  - Financial losses
  - Re-establishing attacked ID: On average 21 hours
- Verification & authentication process less transparent than offline

eID: Necessary qualities

- Trust
- Data control
- Usability
- Interoperability
  - Mutual trust for administrations
  - Provide various security levels for eID services
  - Context sensitive approach
  - Provide private sector participation

eID: Necessary qualities

- Role of personal devices
  - 2011
    - 6,8 billion inhabitants
    - **4,6 billion mobile phones**
    - 1,7 billion Internet users
    - 1.6 billion TV:s
    - 3,9 billion radios
- Privacy protection
  - Pseudonymity & anonymity
- Documentless proof of ID?

eID: Challenges

- Need to prove ID on the Internet
- Verify identity of virtual counterpart
  - In eCommerce
  - In eGovernment
- Solution:
  - eID
  - eID management
  - Provide critical infrastructures for electronic businesses and governement & administration

eID: Security measures

Security of the eID document

Cryptography

Security protocols

Biometric techniques

Security of eID chips

"**FIDELITY**: **F**ast and trustworthy **I**dentity **D**elivery and check with **e**Passports **l**everag**i**ng **T**raveler privac**y**"

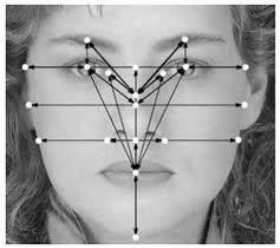
SEVENTH FRAMEWORK PROGRAMME

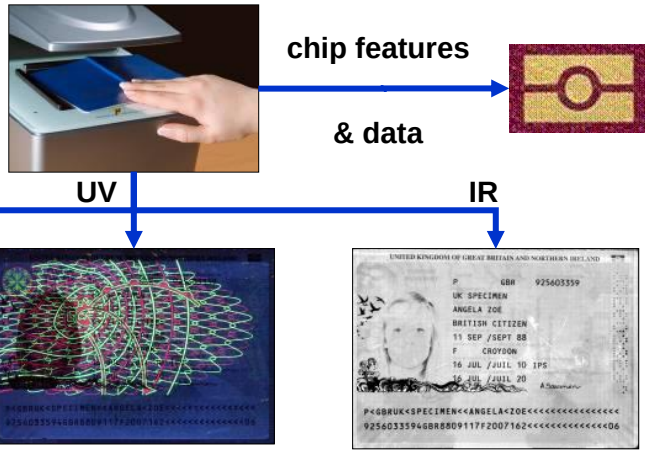
The ePassport

High efforts to make **travel documents more secure**, especially since September, 11

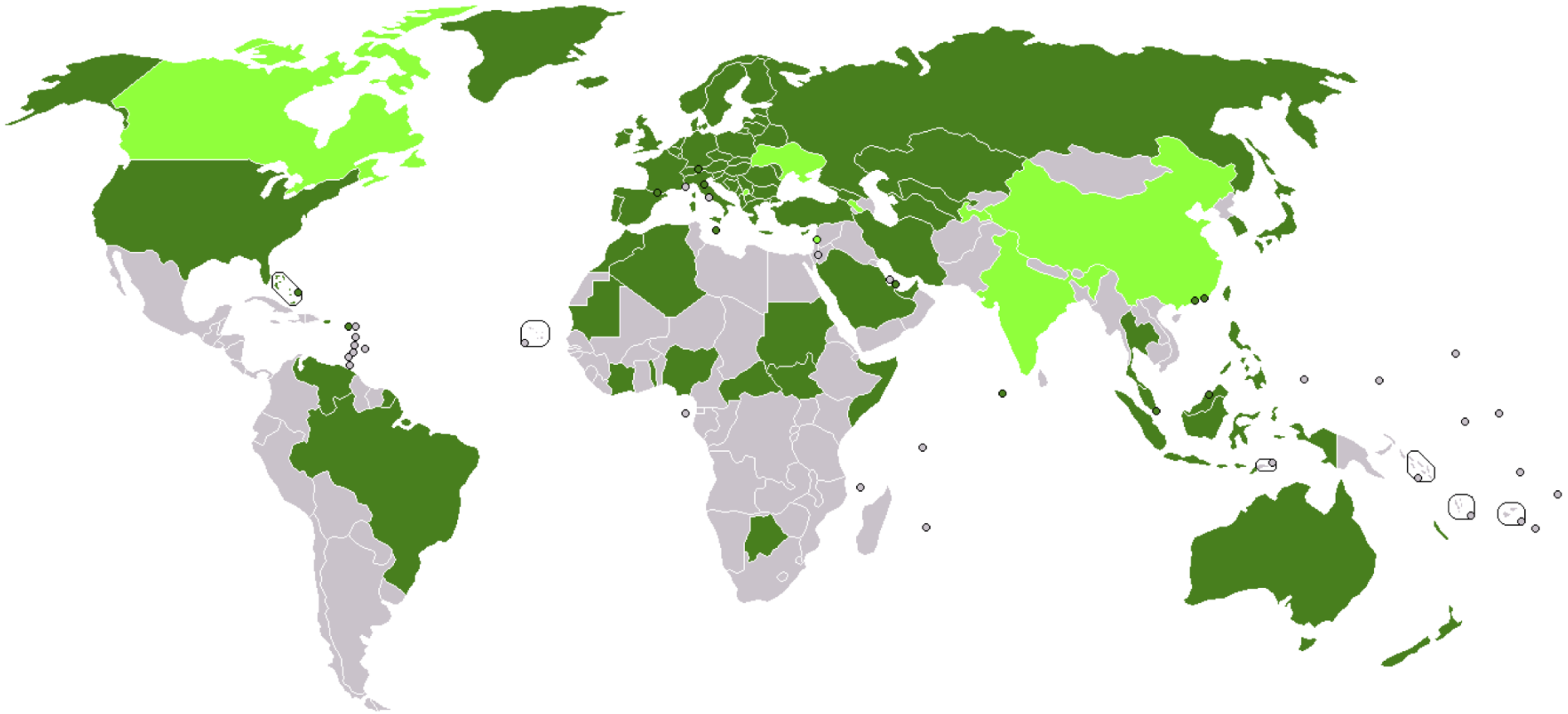
Launch of the **ePassport**

- specified by **ICAO**
- most difficult to forge travel document ever
- **embedded chip**
- **biometry** for ID checks





Success in ePassport deployment

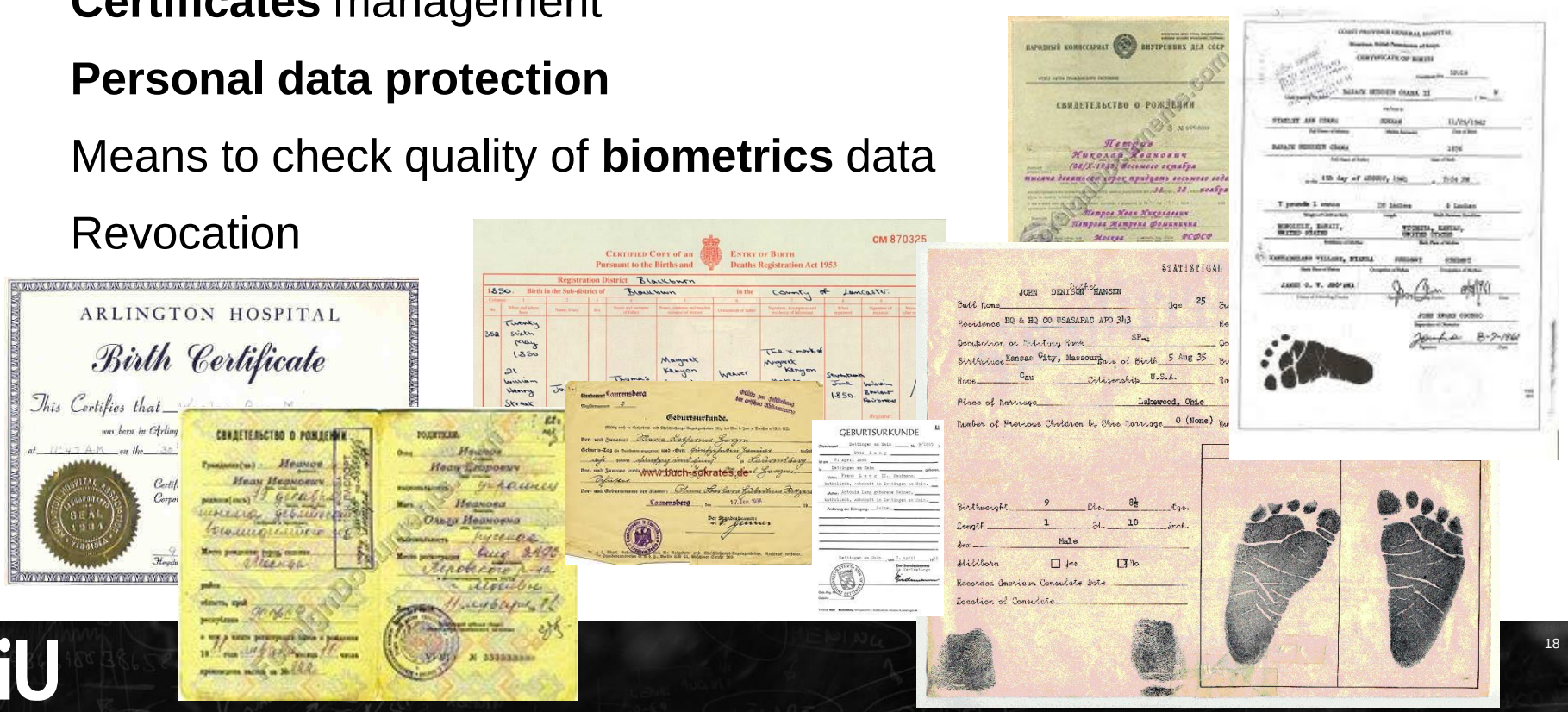


345 million ePassports issued by 93 states
(ICAO estimates in July 2011)

But …

After several years of use, some weaknesses became apparent in

- ePassport **issuing** process, security of **breeder documents**
- **Speed** of ID checks at borders
- Connections with **remote data bases** (SIS, VIS, Eurodac, PNR, ...)
- **Certificates** management
- **Personal data protection**
- Means to check quality of **biometrics** data
- Revocation



Frontex study

Reliability of the e-passport issuance

Information exchange

Training (and possibly tool provisioning)

Compile good practices

Common guidelines

Inter-country review

Lookalike fraud with e-passports is a substantial risk for EU/Schengen border control.

Improve the quality of the digital facial image

Usage of fingerprints in border control

Frontex study

The usage of e-passport functionality is limited and not uniform.

Training of border guards

Deployment of e-passport inspection

Harmonisation of the inspection procedure

Collect real-life performance data from Automated Border Control system pilots

Experienced operational difficulties in deploying e-passport inspection infrastructures.

Public key infrastructures

Document signing certificates in the e-passports

“Defect lists” in inspection systems

Frontex study

Cloning of e-passport chips is a serious concern.

Authenticating the chip in all EU e-passports

Security of national identity cards is not standardised, weak link in border control. (C6)

Phasing out the usage of the SHA-1 secure hash function as part of signing e-passport information.

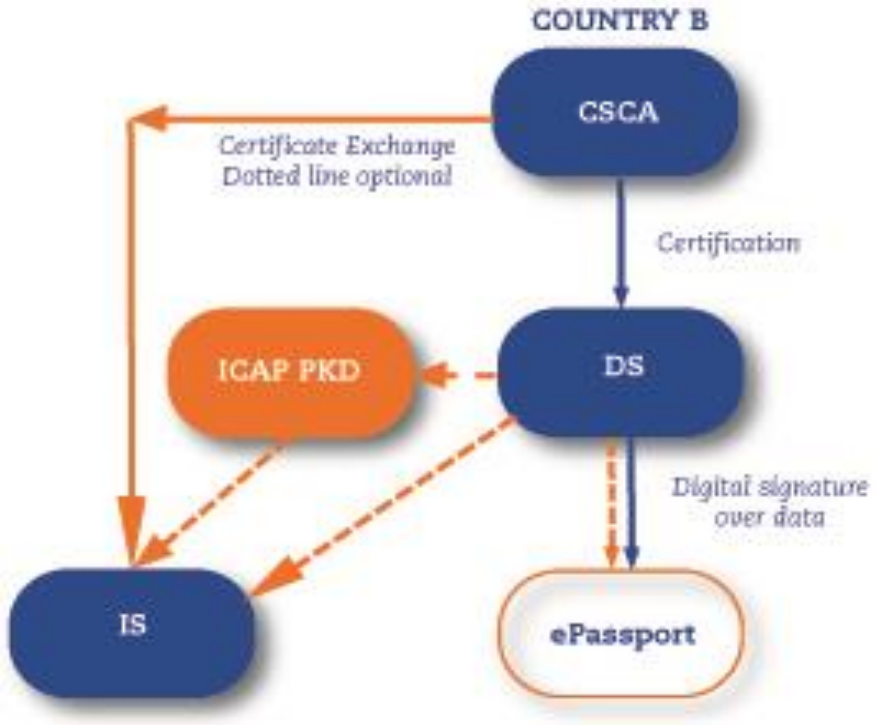
Frontex study

The technical security measures: Increasingly hard to circumvent & standardised to a high degree

Focus of fraudsters is shifting towards the inspection and issuance procedures.

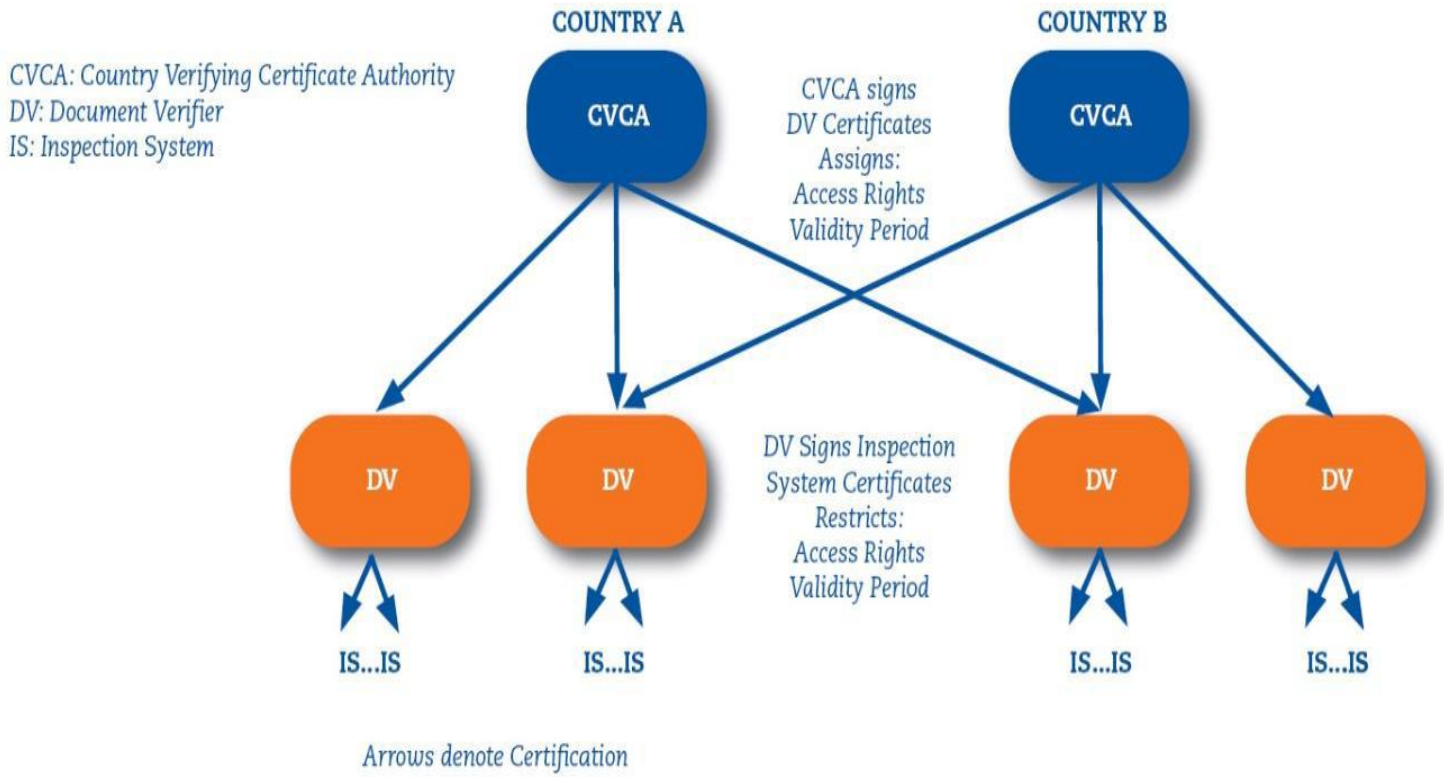
Country Signing Public Key Infrastructure (PKI)

Used to verify the integrity of the data in the passports chip (has the data not been changed) and their authenticity (does the data originate from an official issuing authority)



Country Verifying Public Key Infrastructure (PKI)

Authenticates the inspection terminals of automated border control



Biometrics, definition

"The automated use of physiological or behavioural characteristics to determine or verify identity”

Bio from Greek life

Metric from Greek measurement

In this case we measure

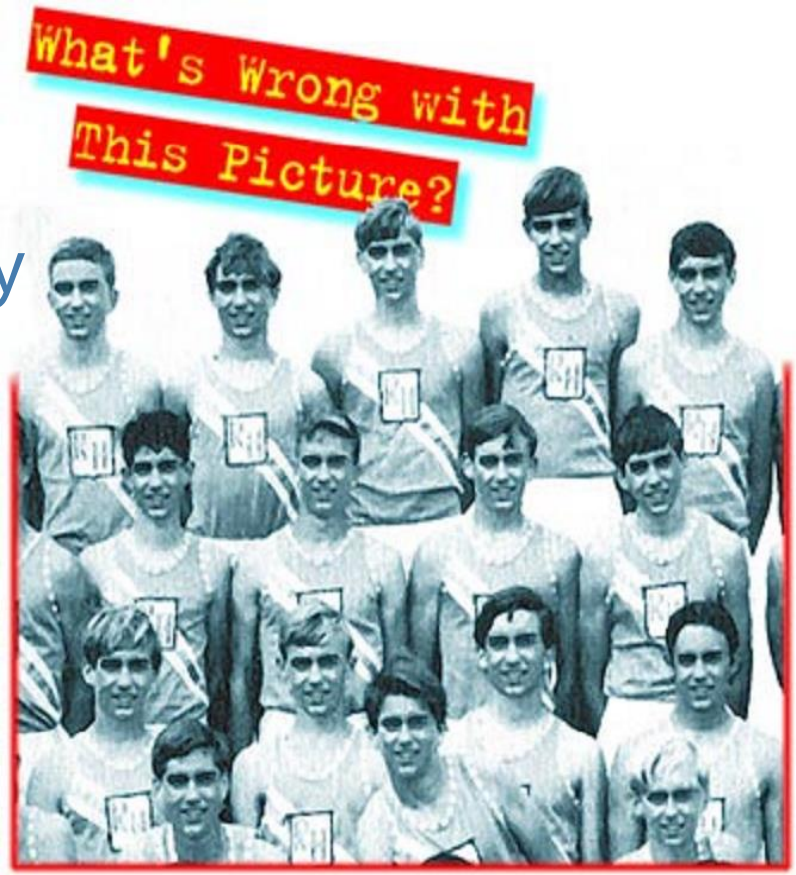
- Physical properties of the user’s body
- Behaviour properties of the user

Biometrics

One of the remarkable abilities of humans and most animals is to identify other individuals

Humans do it primarily through face and voice.

Body proportions, movements etc. are also important



Using the anthropometry for biometrics is not a new idea...

Alphonse Bertillon 1853-1914

Identification through a system that involved around eleven measurements of the human anatomy

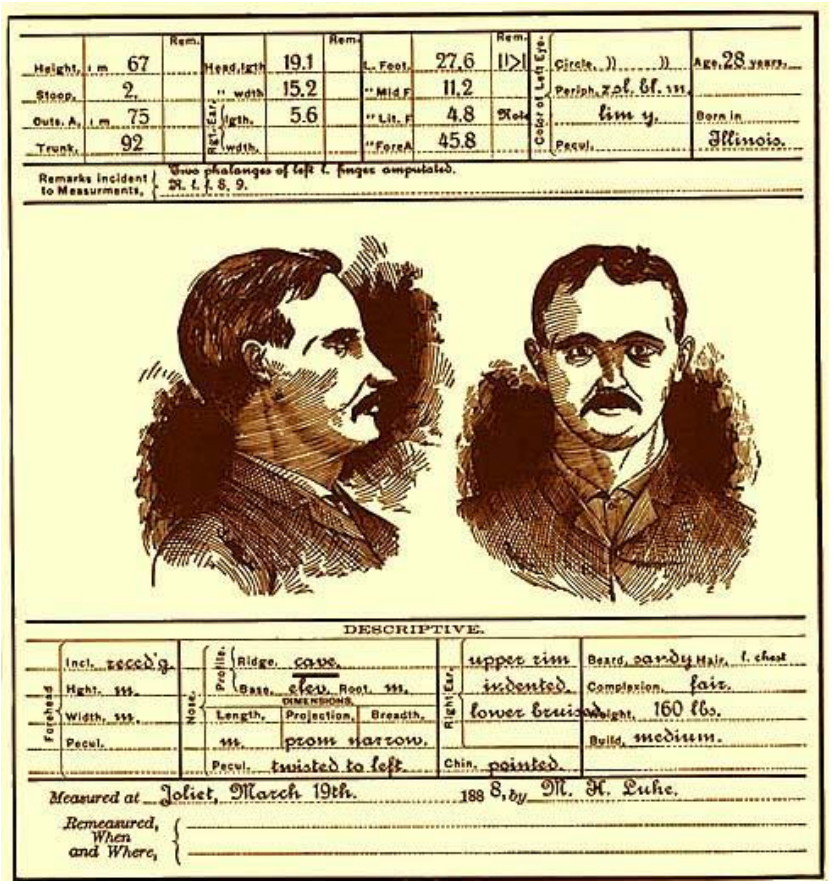
Paris, 1882

“Portrait parlé"

About an identification process that enables finding the name of a repeat offender based on his description only, and that can be used in the context of a classification of photographies in the police headquarters, in the national security office, at the ministry of justice, etc.

Alphonse Bertillon, 1881.

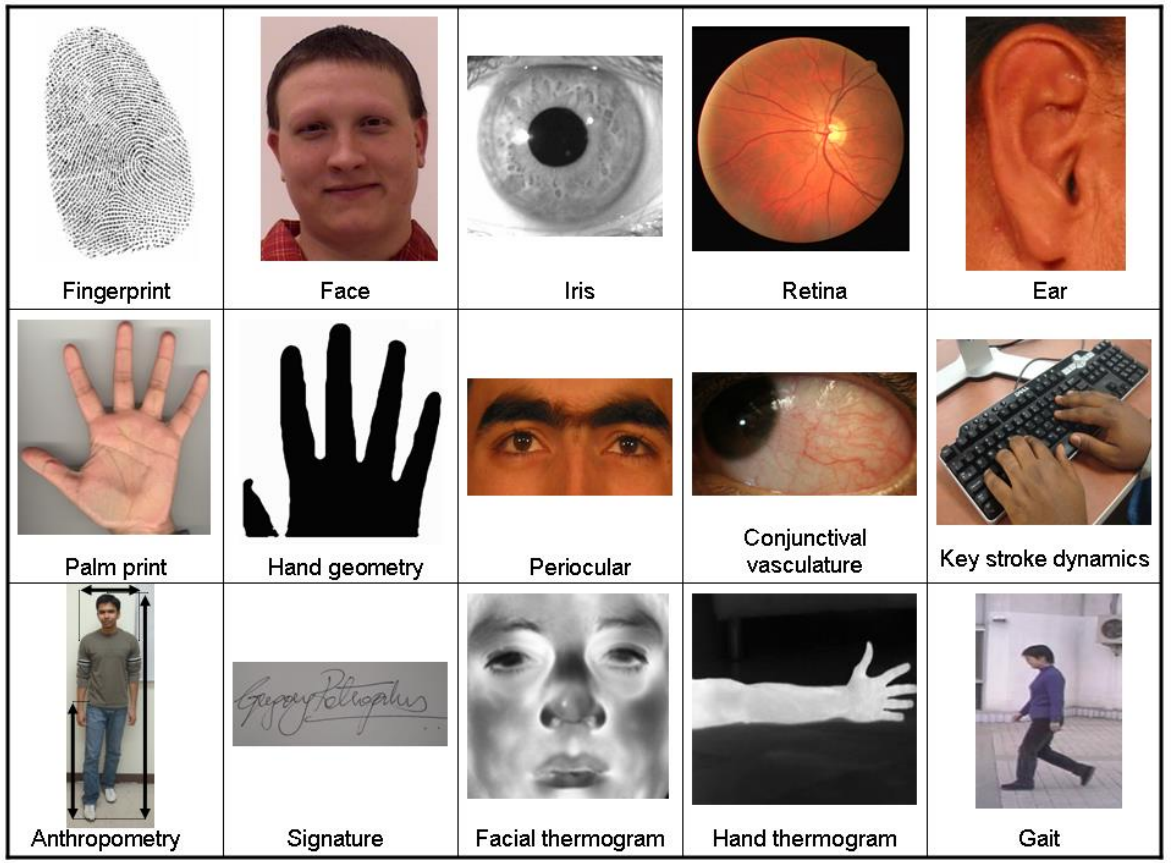
- body measurements
- iris coloration
- photography
- individual particularities (including fingerprints)

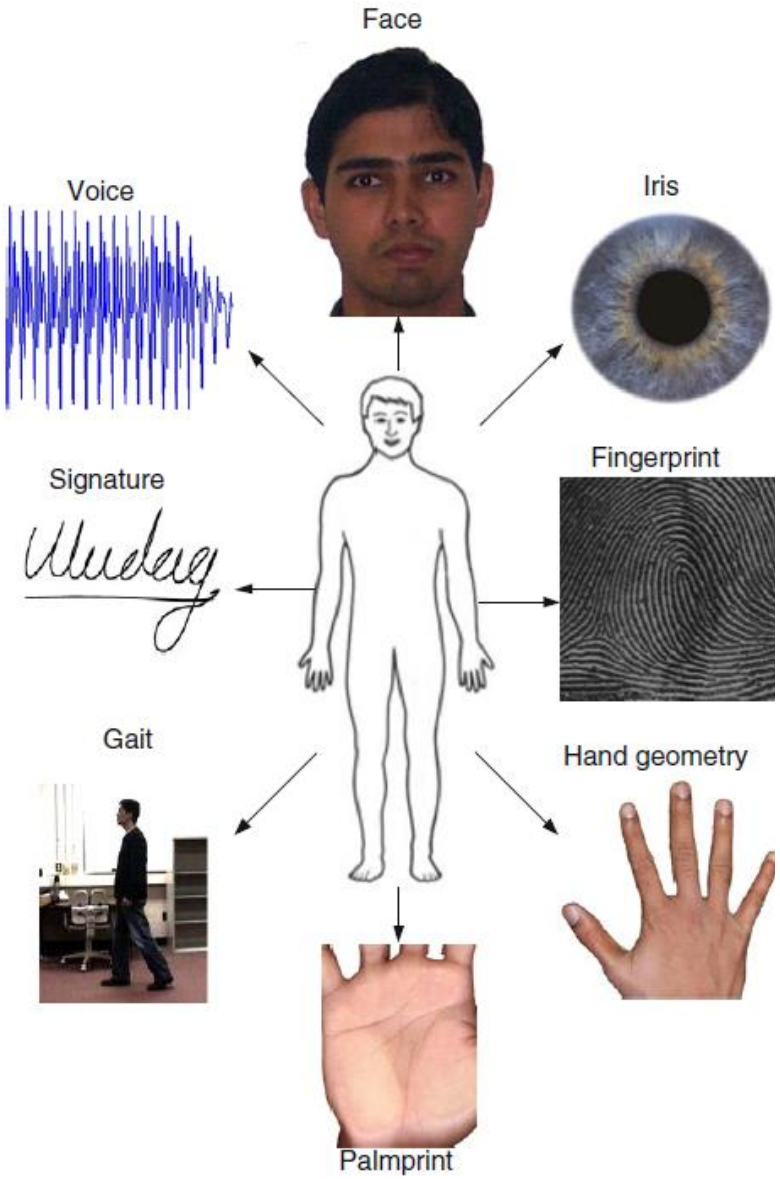


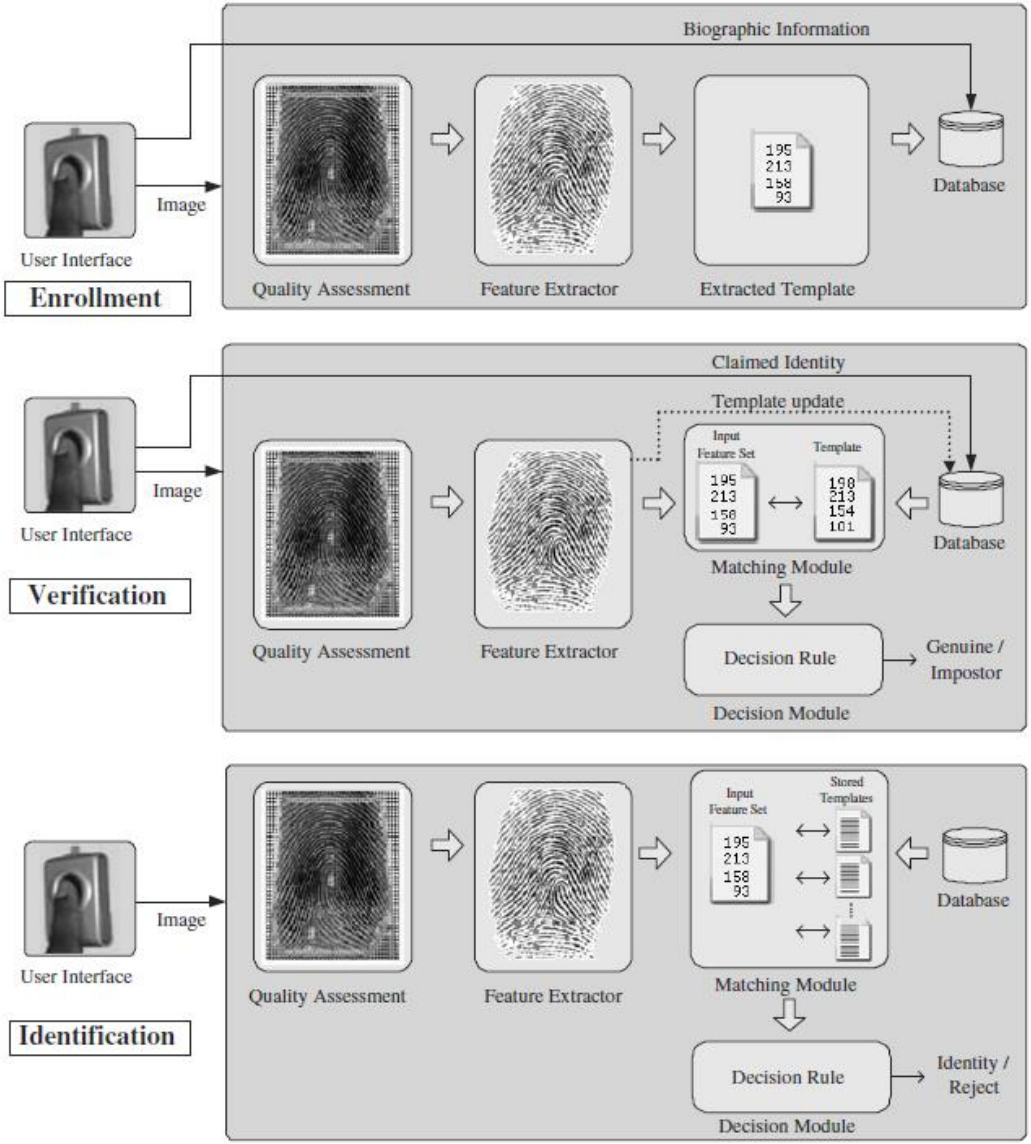
Anthropometry

Biometrics, examples

- Written signature
- Retinal scan
- DNA
- Vein pattern
- Thermal pattern of the face
- Keystroke dynamics
- Finger prints
- Face geometry
- Hand geometry
- Iris pattern
- Voice
- Ear shape
- Body motion patterns

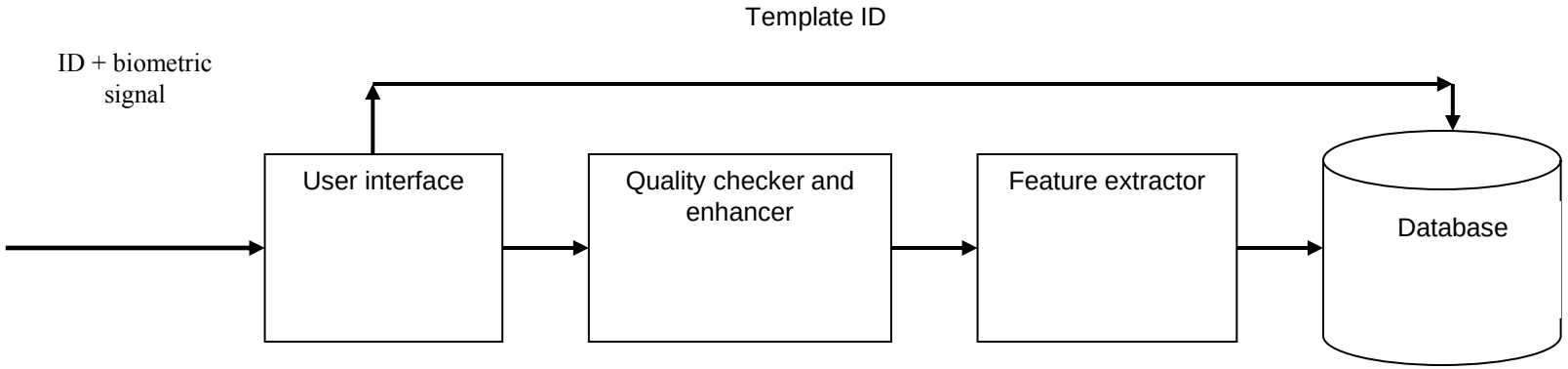



Face
Voice
Iris
Signature
Fingerprint
Gait
Hand geometry
Palmprint


Biographic Information
Image
User Interface
Enrollment
Quality Assessment
Feature Extractor
Extracted Template
Database
Claimed Identity
Template update
Input Feature Set
Template
Matching Module
Decision Rule
Genuine / Impostor
Decision Module
Verification
Identification
Stored Templates
Identity / Reject

Enrollment

Creating a user template

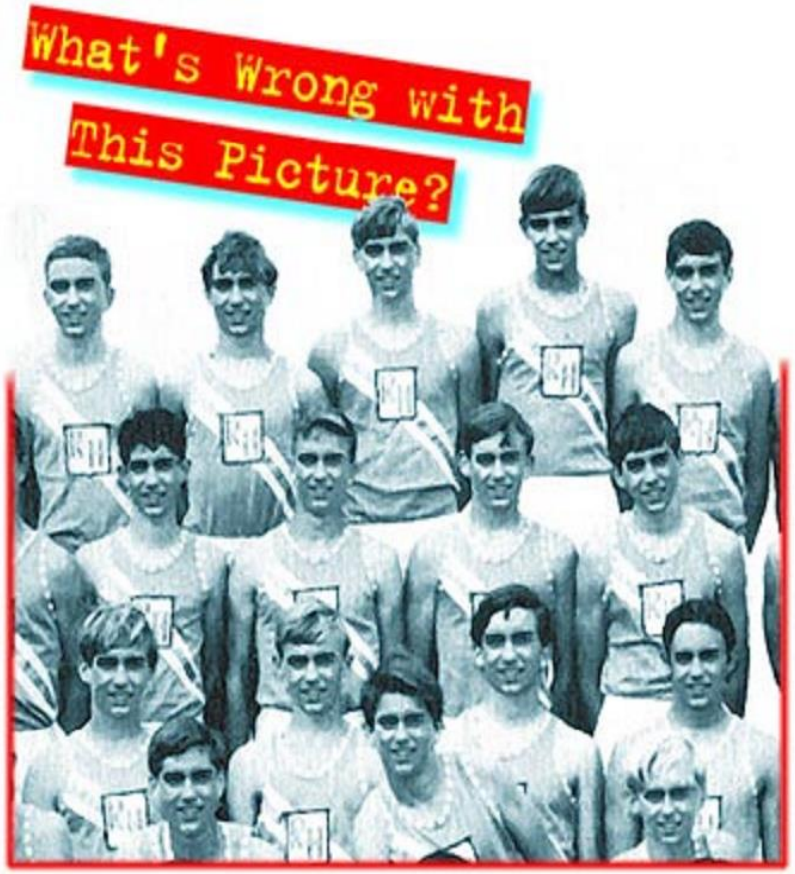


Identification

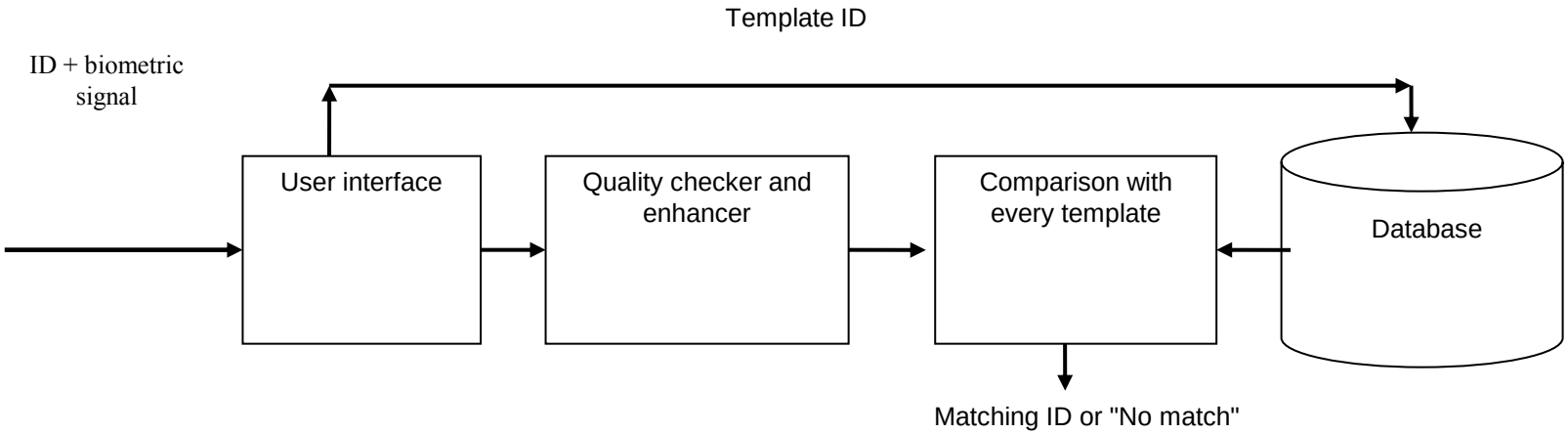
"Who am I?"

Comparisons are made with every template in the database

The result is an identity (name or user ID) or "NO MATCH"



Identification



Identity verification = Authentication

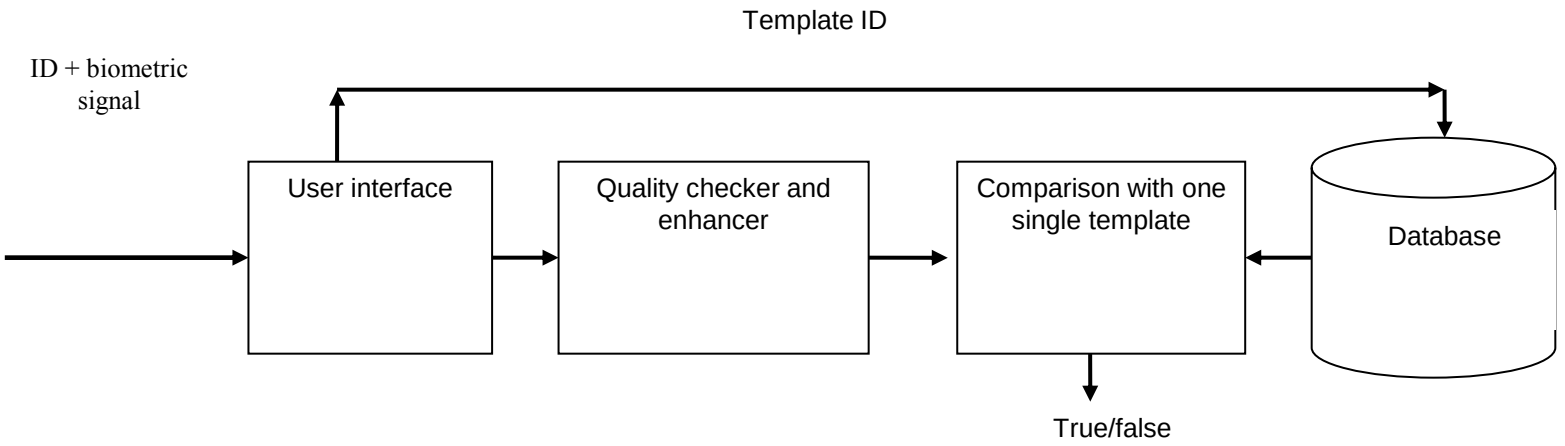
"Am I the person who I claim I am?"

The user claims to have a certain identity (e.g. by specifying a user name)

Comparisons are made only with one template.

The result is TRUE/FALSE

Identity verification



Matching, decision regions, hypothesis testing

A typical system has a threshold parameter which determines the allowed variance

Statistical theory for hypothesis testing enables analysis

It is necessary to balance user population statistics against intended use

More about this …

Statistics in user authentication

Problems and unexpected effects

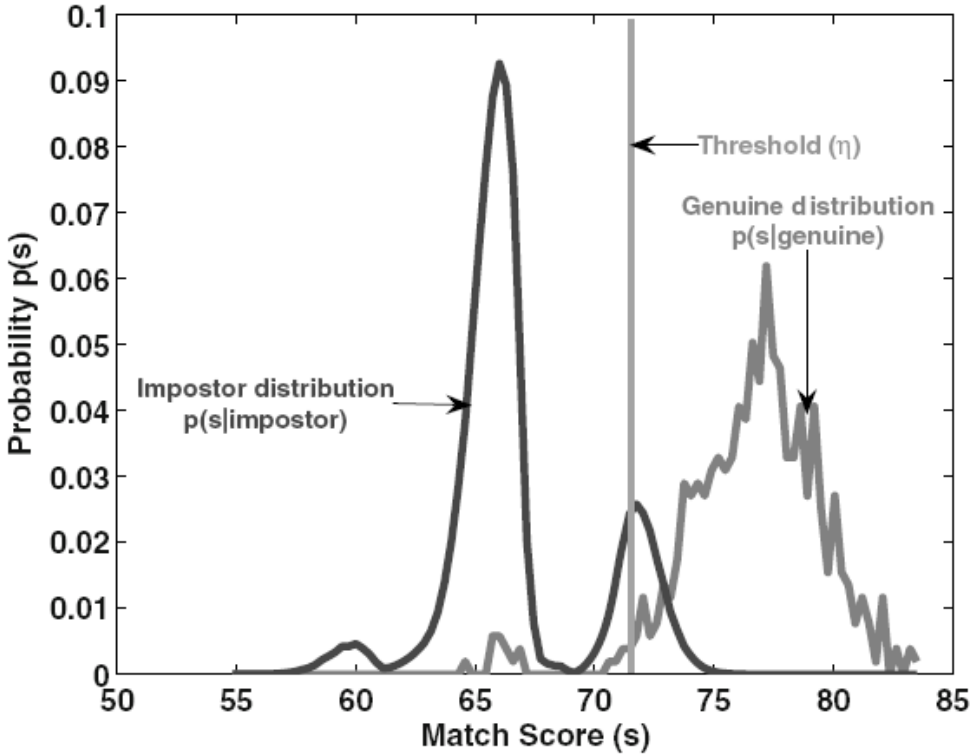
Statistics in user authentication

For identification, you must consider the probabilities that two persons ever have matching authentication data

For verification, you must estimate the probability that an impostor can guess a victim's parameter value and imitate it

Statistics in biometrics

- A typical system has a threshold parameter which determines the allowed variance
- Use statistical theory for hypothesis testing
- Balance user population statistics against intended use plus importance of each of the CIA criteria, and set thresholds accordingly



Failure rates

Admitting a person under the wrong identity

FAR – False Acceptance Rate, also called

FMR – False Match Rate

Rejecting a person claiming correct identity

FRR – False Rejection Rate, also called

FNMR – False Non-Match Rate

Failure rate effects

Remember:

Admitting a person under the wrong identity means damaged Confidentiality and/or Integrity

Rejecting a person claiming correct identity means damaged Availability

Identification effects

Hypothesis testing answers “True” or “False”

Hypothesis can be “this is person X”

Highly unbalanced in the sense that most subjects are not person X

Creates effects that surprise some

Identity testing problems

Suppose there are 10,000 persons on a “no fly” list

An airport uses identification devices with FAR=0,1% and FRR=5%. Reasonable values?

- A terrorist has a 5% chance of getting aboard. Send 20 and one will succeed
- A typical airport like Arlanda (≈ 50 000 passengers per day) will detain 50 innocent people each day

Agenda for lecture I within this part of the course

Background

Statistics in user authentication

Biometric systems

Tokens

Authentication✔

eID✔

ePassports✔

Biometrics in general✔

Statistics(✔)

Generic biometric system

Fumy, W. and Paeschke, M. Handbook of eID Security

A. Jain, A. Ross and K. Nandakumar, Chapters 1 in "Introduction to Biometrics"

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