Second Symposium & Workshop on ICAO-Standard MRTDs, Biometrics and Security

Face Biometric Capture & Applications

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Secure Identification & Biometrics

UNISYS

International Organization for Standardization (ISO)

MRTD Symposium

ICAO Headquarters, Montreal

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Identity Concepts – Who are you ?

1. **Something You Have**
   - Driver license, passport, token (PKI), Smartcard …
2. **Something You Know**
   - PIN, Password, family name, date of birth, word/phrase
3. **Something You are Still Entitled to**
   - Passport not lost, citizenship not revoked
4. **Something You Are (Biometrics)**
   - Physical Characteristics
   - Behavioral Characteristics

What are Biometrics ?

Biometric – What is it?

Biometrics is the automated technique of measuring a physical characteristic or personal trait and comparing it to information in a database or on a token for the purposes of positive identification

Types of Biometric

- DNA
- Retina Scan
- Iris Recognition
- Voice
- Hand Geometry
- Skin texture
- Vein Patterns
- Fingerprint – 100 years
- Face Recognition – since forever

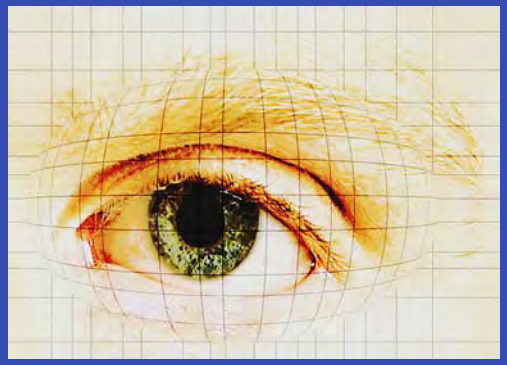
Face recognition is the globally interoperable biometric for MRTDs !

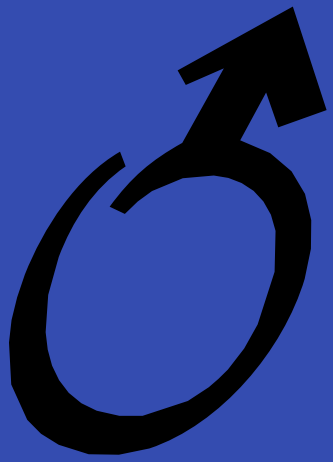
Finger & Iris are optional supporting biometrics

Identity Theft

(cautionary folklore)

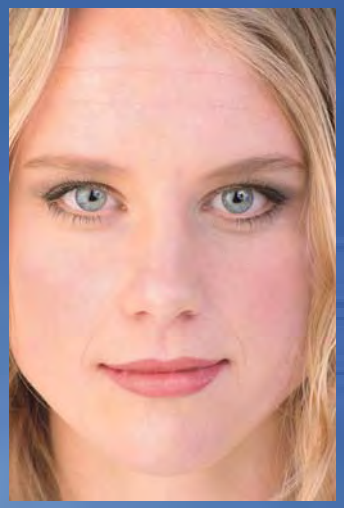
A folk Tale: Little Red Riding Hood

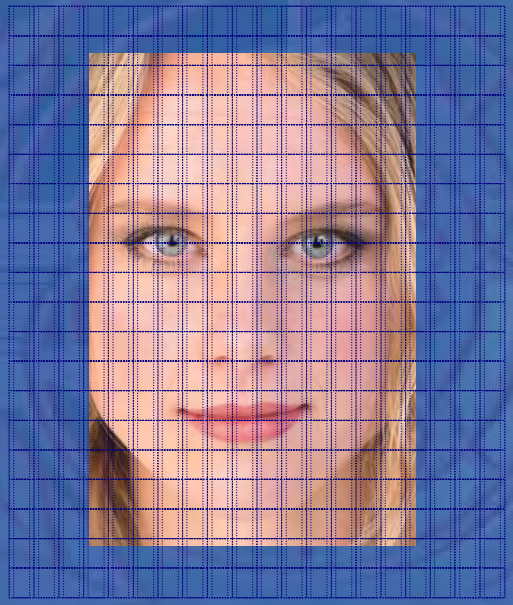




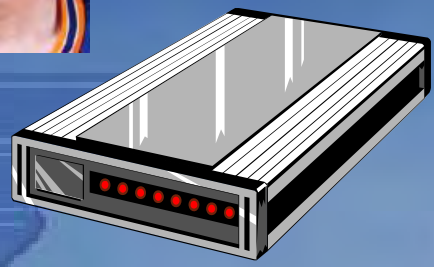
What is Facial Recognition ?

Facial Recognition

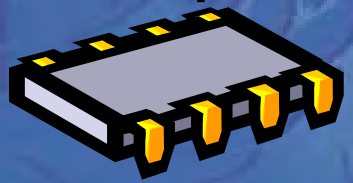




The face recognition process



- User enrollment
- Image capture
- Image processing
  - Image storage
- Feature extraction – Template
  - Template storage



- Comparison 1)*%^$_#* vs 1)%*^S_#*
- Confidence Score eg 9.2 out of 10

Compare

- The photo image extracted from the chip in the passport

- The person standing in front of you at the airport

How do you use it ?

Identification Matching 1:many (database)

"Have we seen this person before under another identity ?"

Verification Matching 1:1

"Is this person who he/she claims to be?"

Watch List Matching

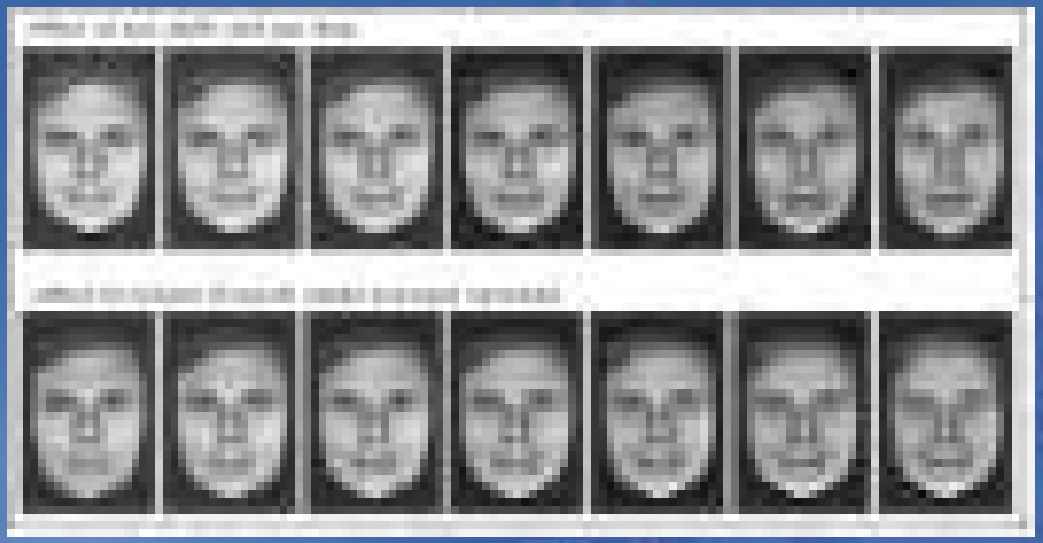
"Is this person on a list of wanted people ?"

Method - Eigenface

- The eigenface technique uses a combination of linear algebra and statistical analysis to generate a set of basis faces--the eigenfaces--against which inputs are tested
- a set of "standardized face ingredients“ is derived from statistical analysis of many pictures of faces
- any human face can be considered to be a combination of these standard faces. One person's face might be made up of 10% from face 1, 20% from face 2 and so on
- the eigenface method can be thought of as reducing a face to a number. First it averages out a database of head shots to produce one composite face. Then it compares the face being identified to the composite. An algorithm measures how much the target face differs from the composite and generates a personal (template) number based on the deviation

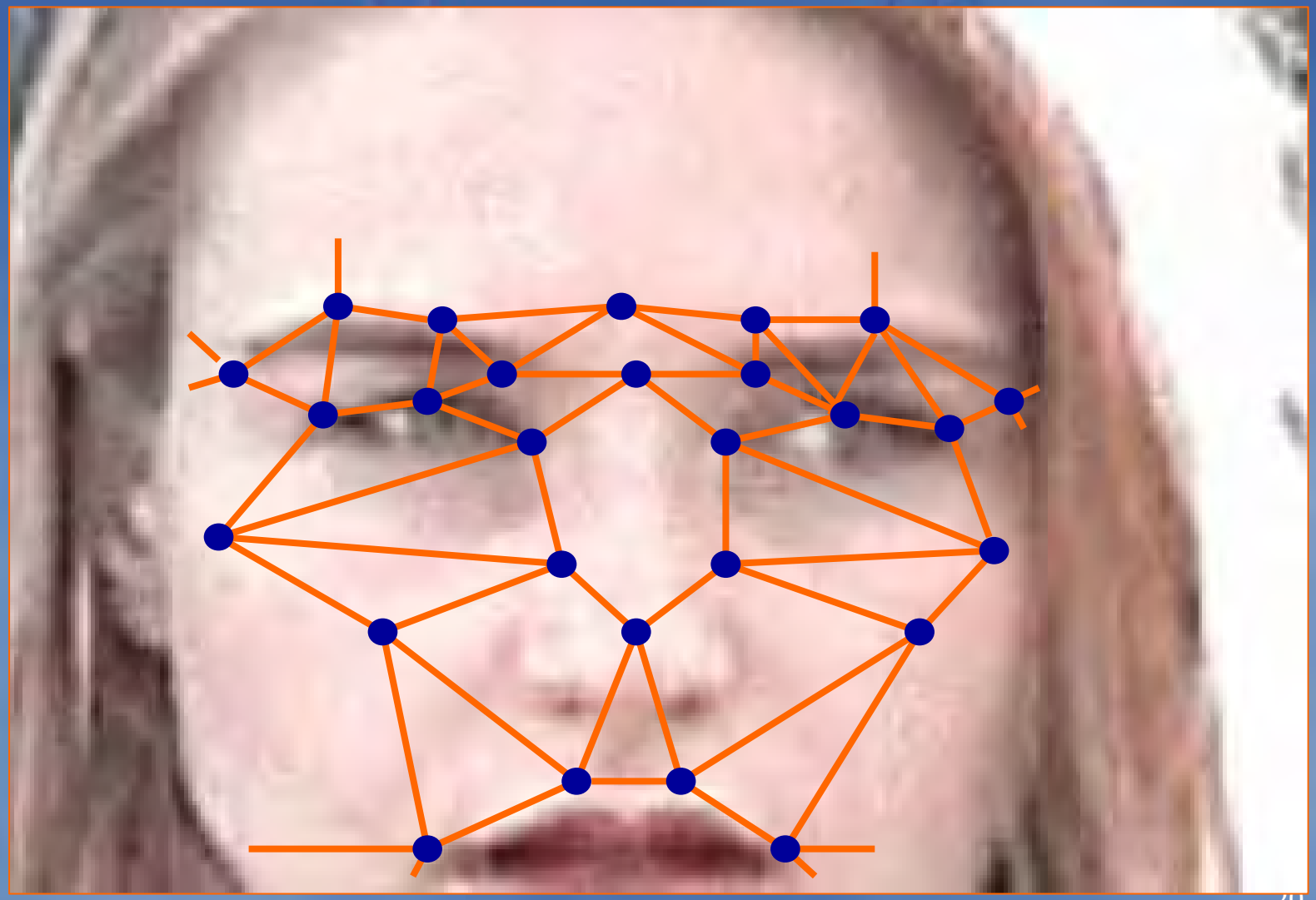
How does Facial Recognition Work ?

Eigenfaces



A bland androgynous human face

Local Feature Analysis



Method – Local Feature Analysis

- Analyzes the pixels that make up the face image
- Compare the darkness of each pixel to that of its neighbours, looking for areas where abrupt differences in value radiate outward from a single pixel.
- These changes can occur between the eyebrows and skin, the eyes and eyelids, or on features that protrude, such as the cheekbones and nose.
- The system plots the location of each pixel, known as an "anchor point," then connects the dots, forming a mesh of triangles based on bone structure so makeup, glasses won't fool it.

Considerations at Issuance

- The photo image provided

Fraud Detection

- Your existing Database

The Importance of Quality Capture of Face
Garbage in = Garbage out

Why enrolment is so important !

Fit for Purpose – eg a Drivers Licence

IME FATIMA

PREZIME AYISHA KHOMEINI

DATUM I MJESTO ROĐENJA 02.12.1972.
KIRKUK, IRAK

JMBG 0212972335009

PREBIVALIŠTE ZAGREB
DUBRAVA 27

PU ZAGREBAČKA
DOZVOLU IZDAO U

POTPIS

07.12.1995.
DANA

06.12.2035.
VRIJEDI DO

0309123
BROJ

POTPIS VOZAČA Fatima Ayisha Khomeini

KATEGORIJE VOZILA ZA KOJE VRIJEDI DOZVOLA:

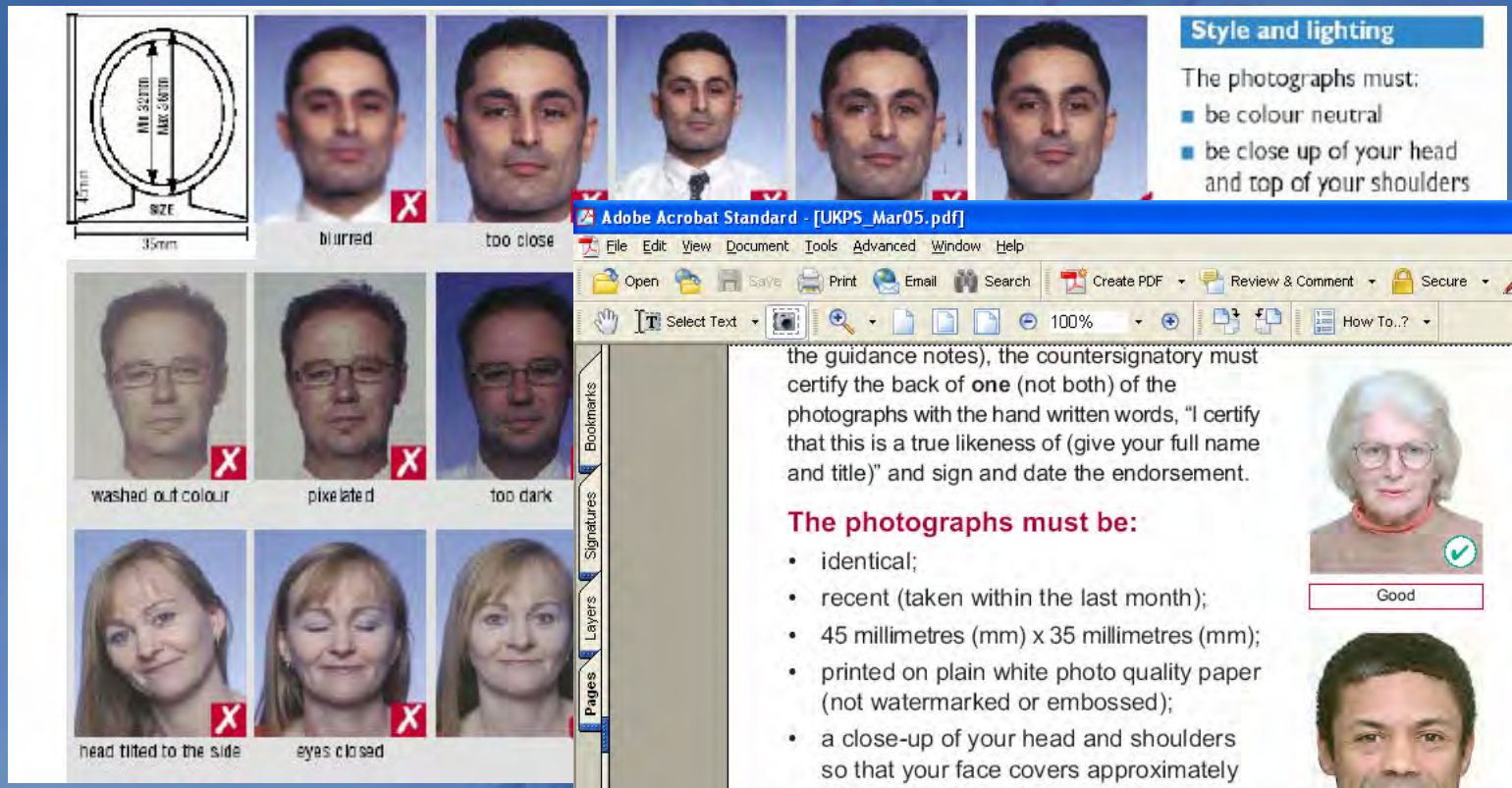
A	Motocikli datum polaganja	M.P.
B	Vozila, osim vozila kategorije A, čija najveća dopuštena masa nije veća od 3.500 kg i koja nemaju više od osam sjedala, ne računajući sjedalo za vozača. 11.04.1991. datum polaganja	M.P.
C	Vozila za prijevoz tereta čija je najveća dopuštena masa veća od 3.500 kg. datum polaganja	M.P.
D	Vozila za prijevoz osoba, koja, osim sjedala za vozača, imaju više od osam sjedala. datum polaganja	M.P.
E	Skupovi vozila čija vučna vozila spadaju u kategoriju B, C ili D, a priključna su vozila najveće dopuštene mase veće od 750 kg. datum polaganja	M.P.

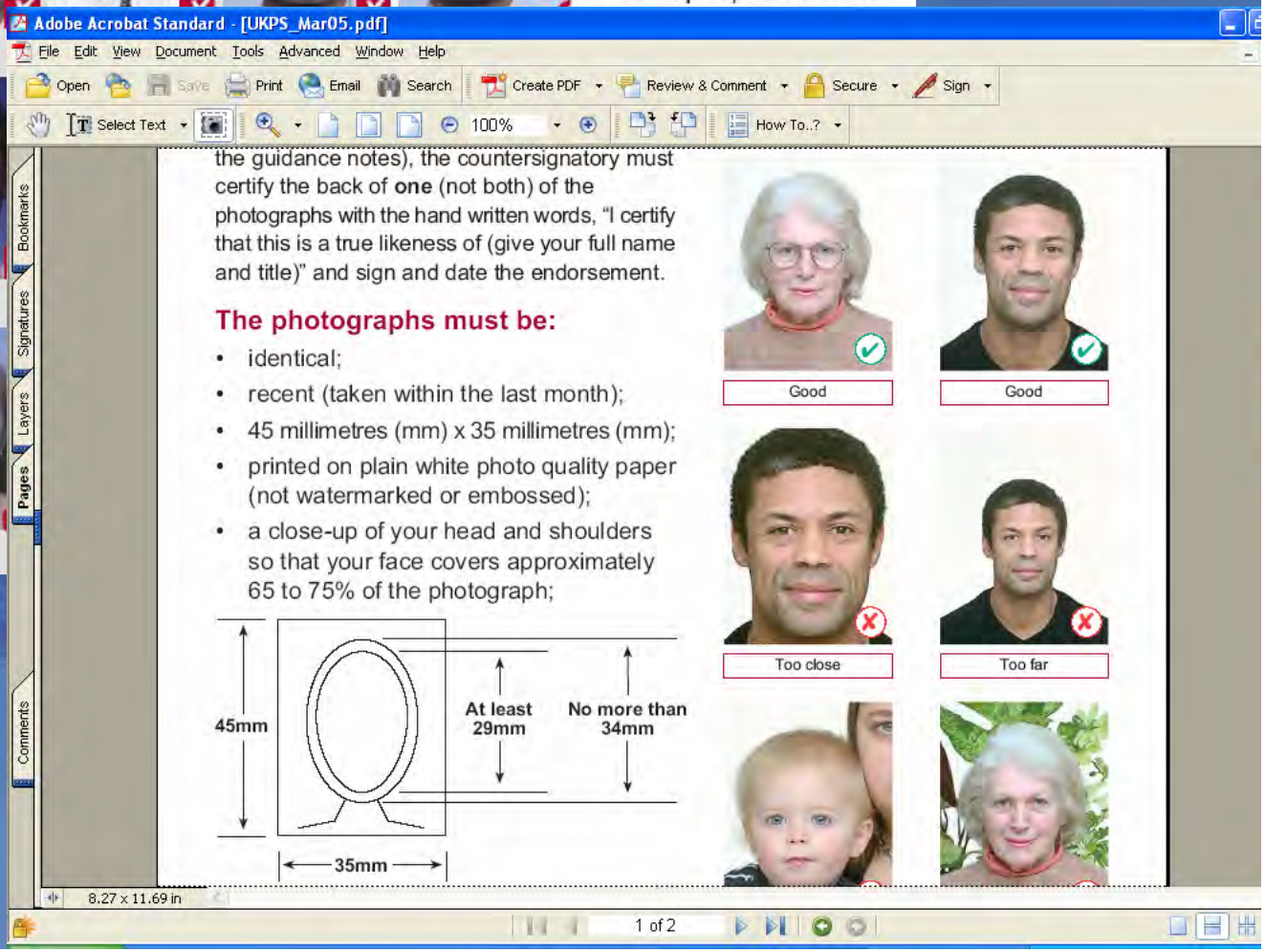
VRSTE VOZILA ZA KOJE VRIJEDI DOZVOLA:

F	Tramvaji datum polaganja	M.P.
G	Traktori 11.04.1991. datum polaganja	M.P.
H	Radni strojevi i mopedi 11.04.1991. datum polaganja	M.P.

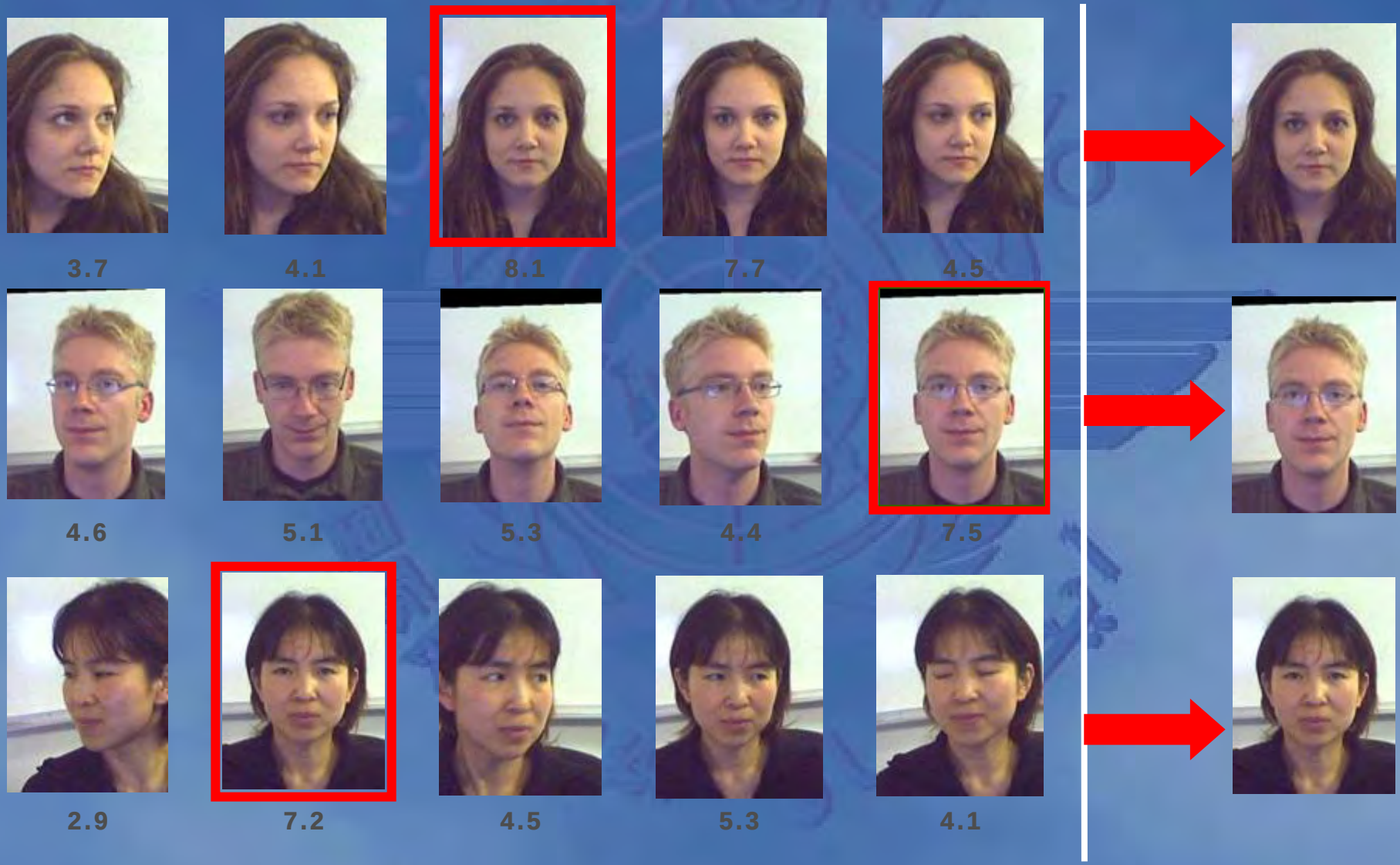
NAPOMENA:

Enrolment - Photograph Guidelines





Quality Assessment



QA Software

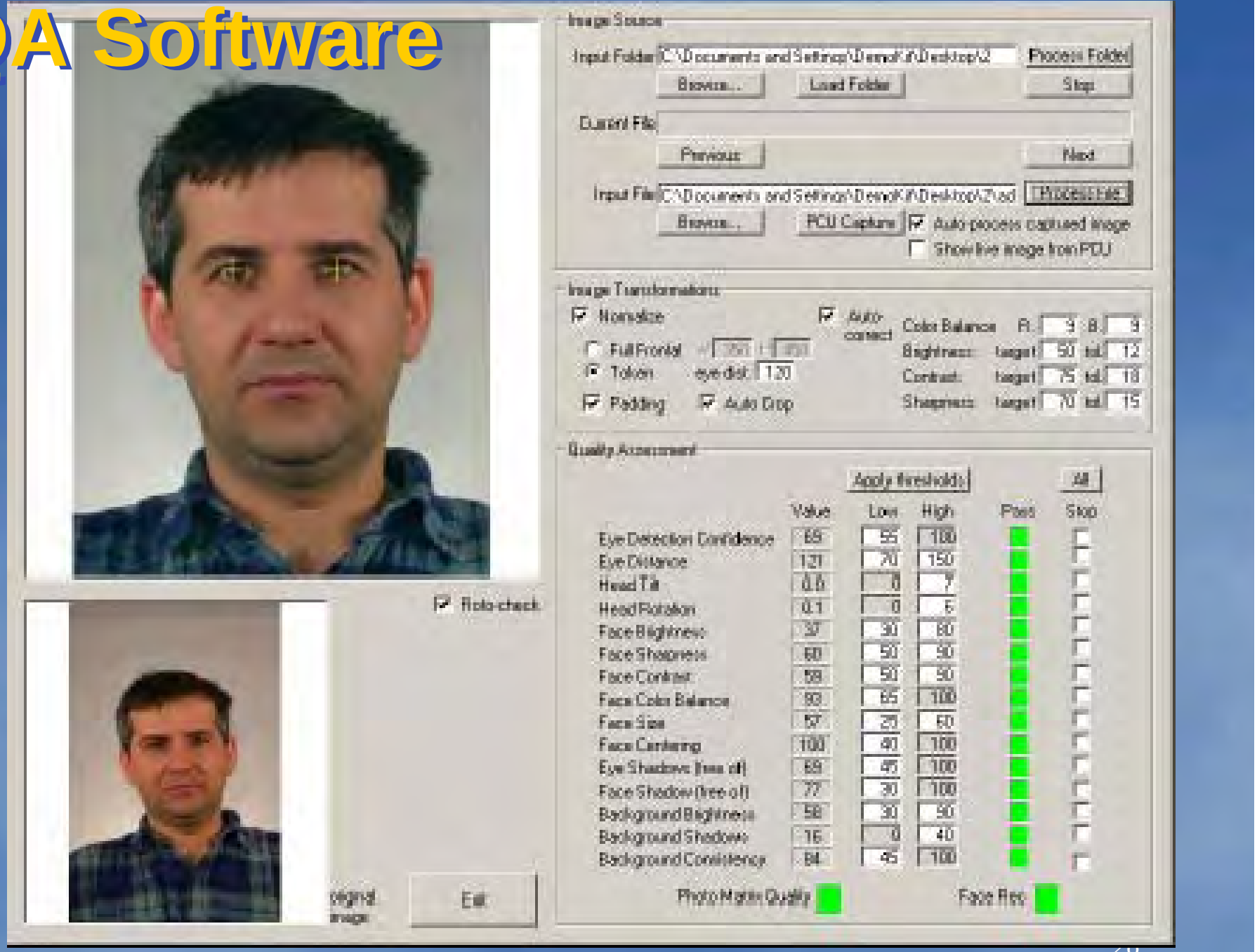
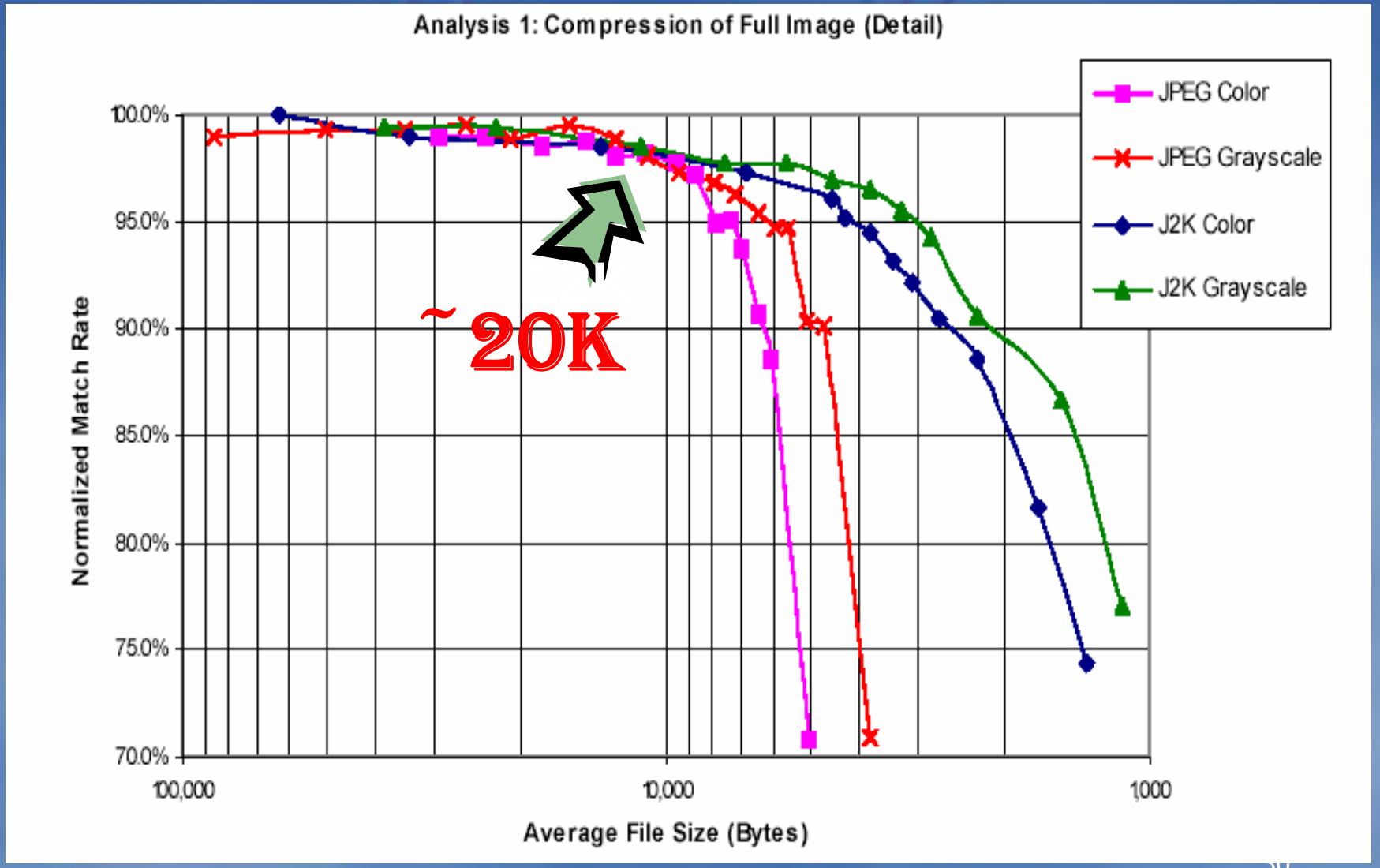


Image Source
Input Folder
Process Folder
Browse...
Load Folder
Stop
Current File
Previous
Next
Input File
Process File
Browse...
PCU Capture
Auto process captured image
Show live image from PCU
Image Transformations
Normalize
Auto-correct
Color Balance
Full Frontal
Token
eye dist
Brightness
Contrast
Sharpness
Padding
Auto Crop
Quality Assessment
Apply thresholds
All
Value
Low
High
Pass
Stop
Eye Detection Confidence
Eye Distance
Head Tilt
Head Rotation
Face Brightness
Face Sharpness
Face Contrast
Face Color Balance
Face Size
Face Centering
Eye Shadows (free of)
Face Shadow (free of)
Background Brightness
Background Shadows
Background Consistency
Photo Master Quality
Face Rec
Photo-check
Exit

Compression & Storage Issues

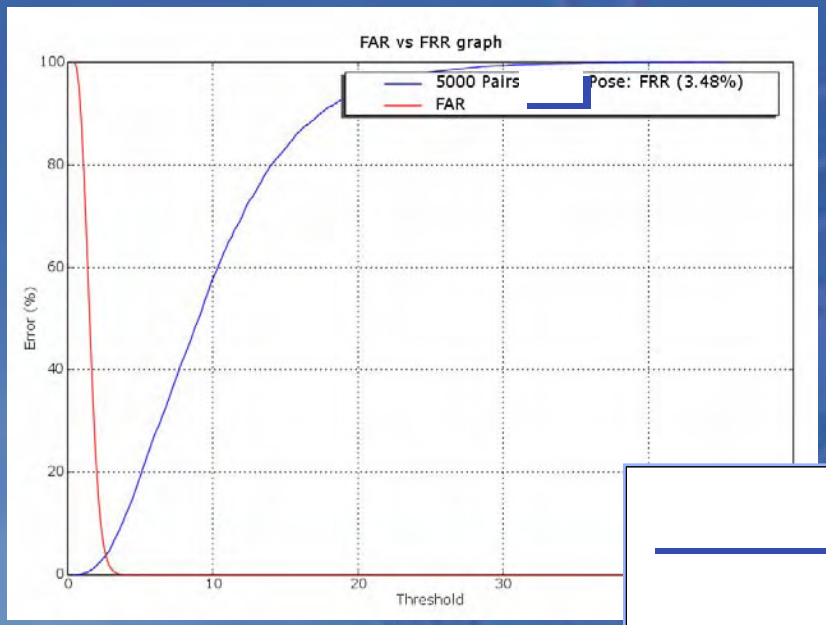
Face Compression Analysis

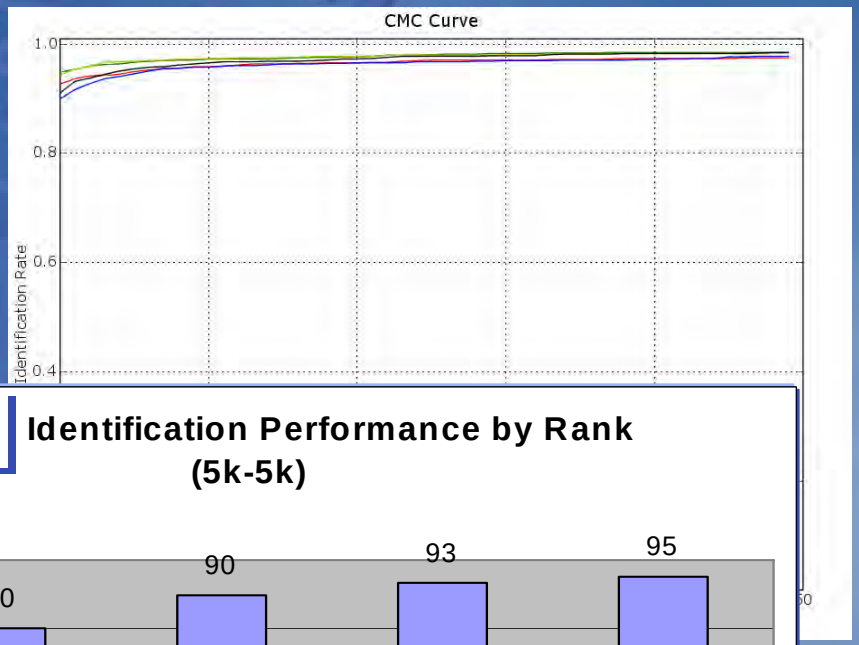


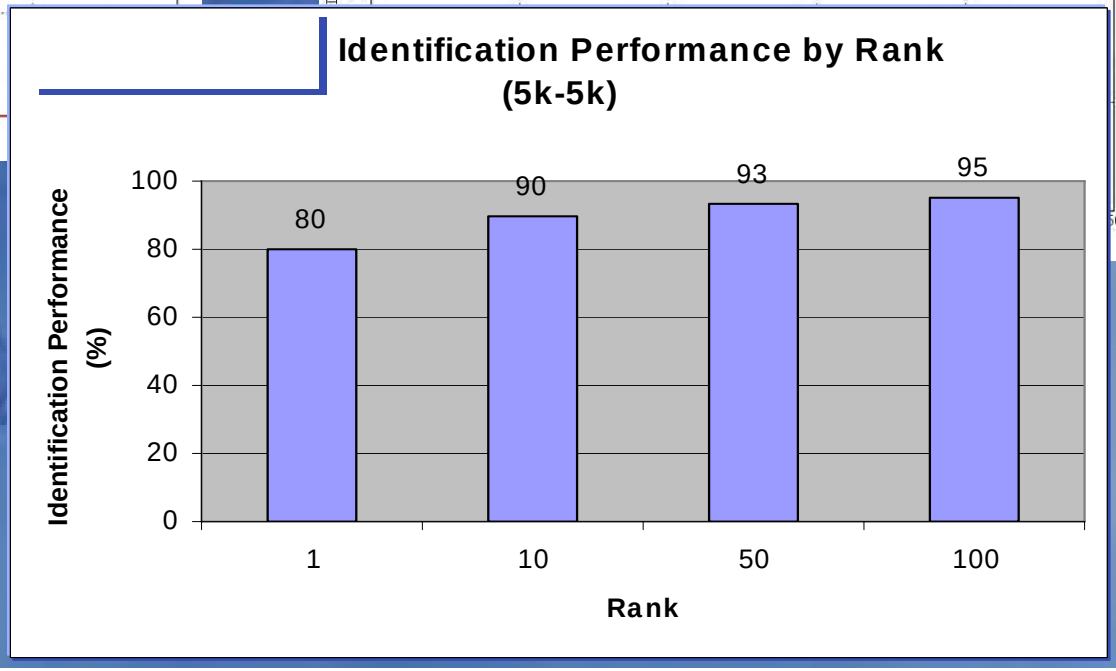
Similarity Test Methodology

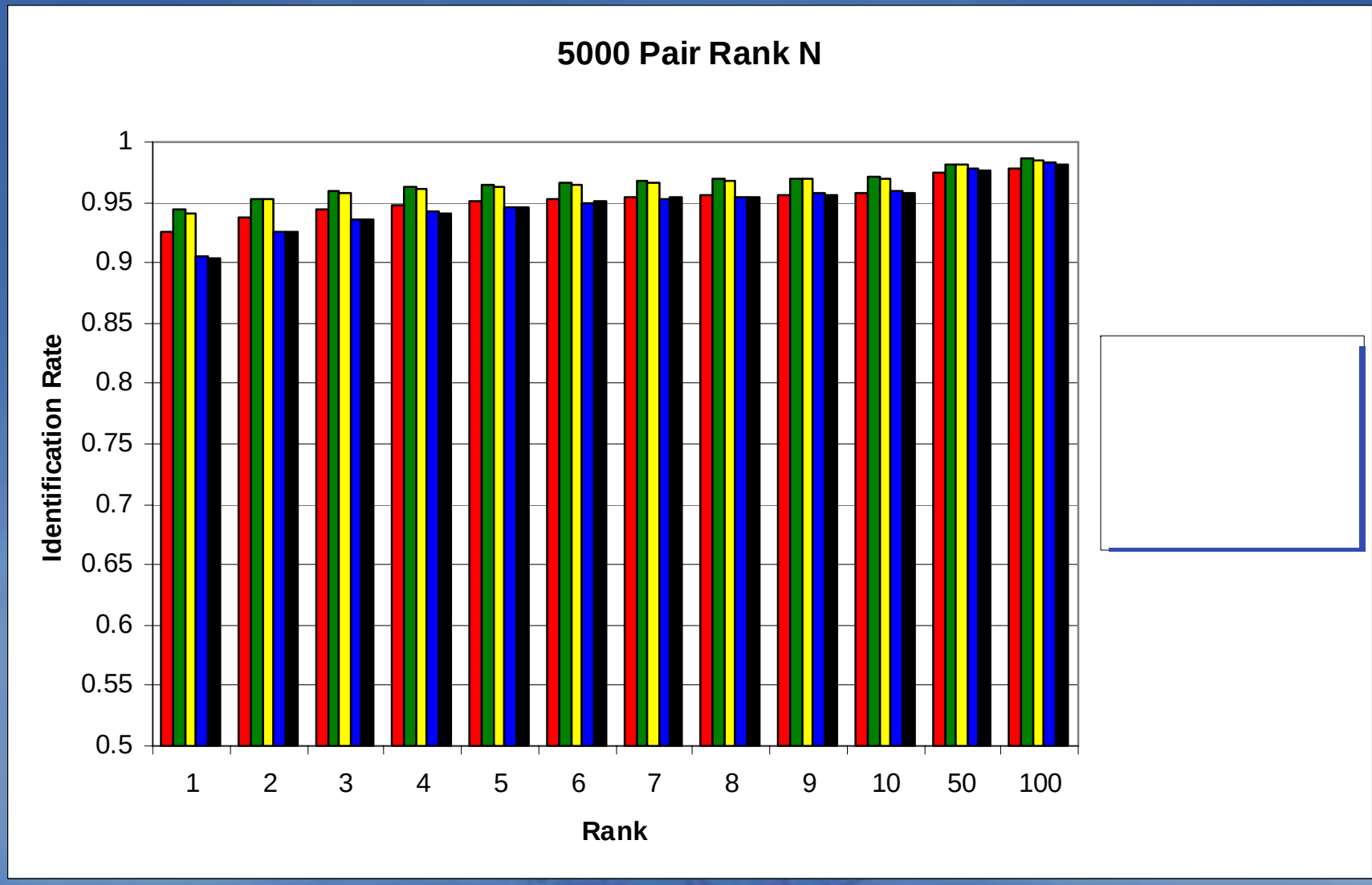
- **Probe and Gallery**
- **The importance of testing your images**
- **pairs of real photos at random age, sex, race, years apart**
- **5000:5000 predicts**
- **5million : 5million**

1:many Identification Matching





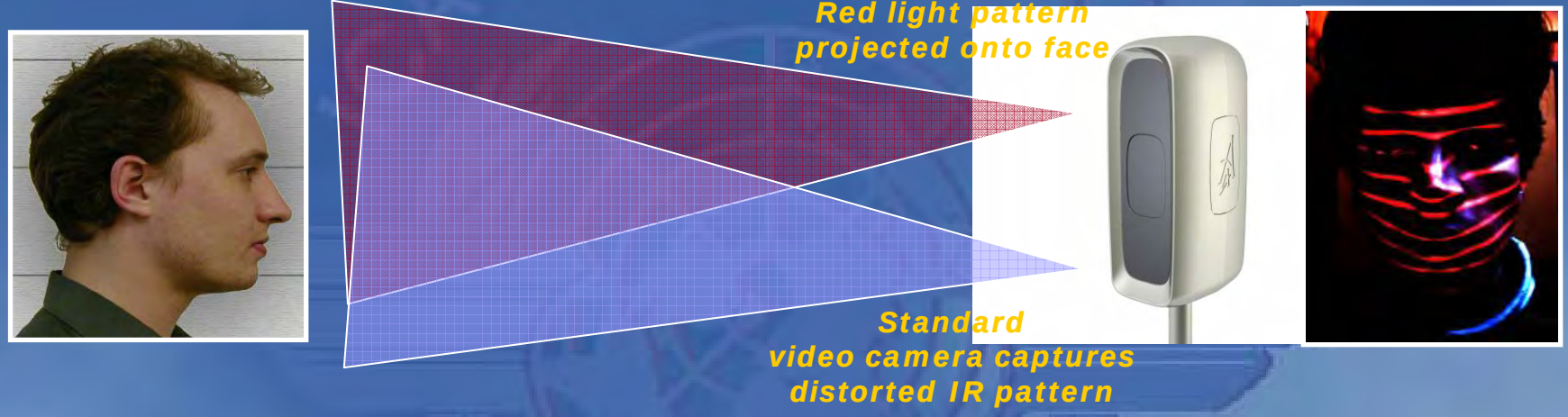



5000 Pair Rank N
Identification Rate
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
1
2
3
4
5
6
7
8
9
10
50
100
Rank

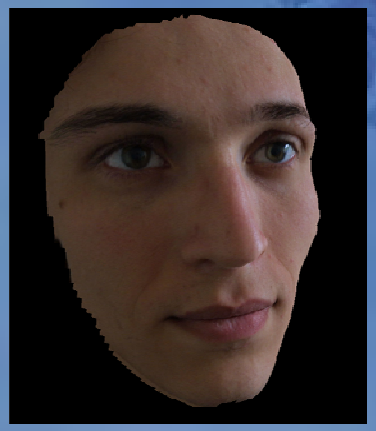
3D

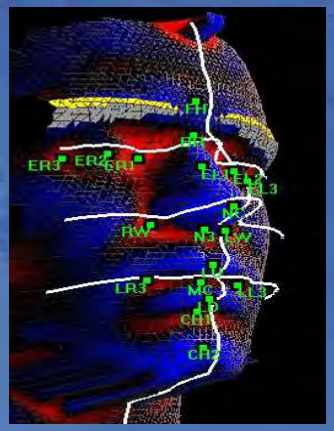
3D Facial Technology

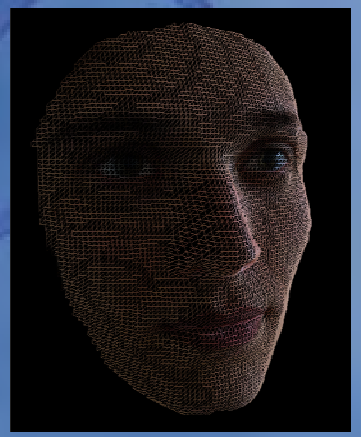
3D video camera based on structured light



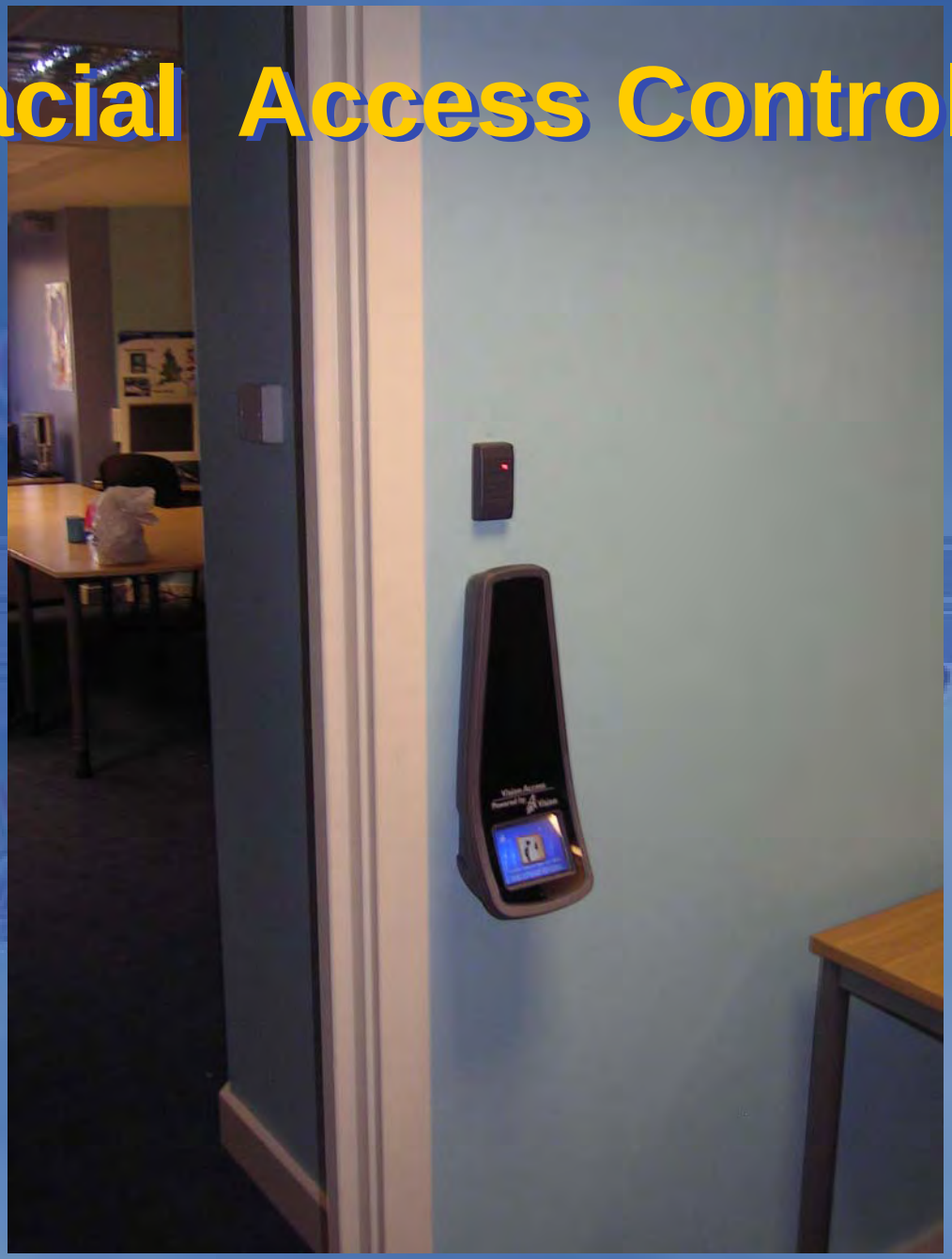
- Invisible near IR light - permits both night & day vision
- 3D and 2D merging from both perspectives







3D Facial Access Control



Considerations at INSPECTION

1-1 1-Watch

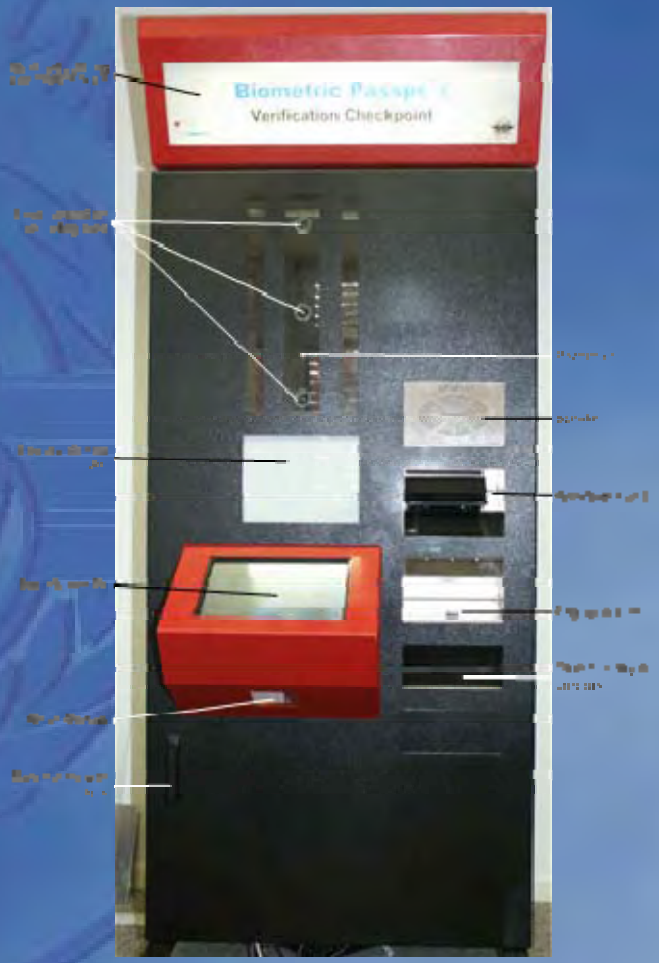
Compare

- The photo image extracted from the chip in the passport

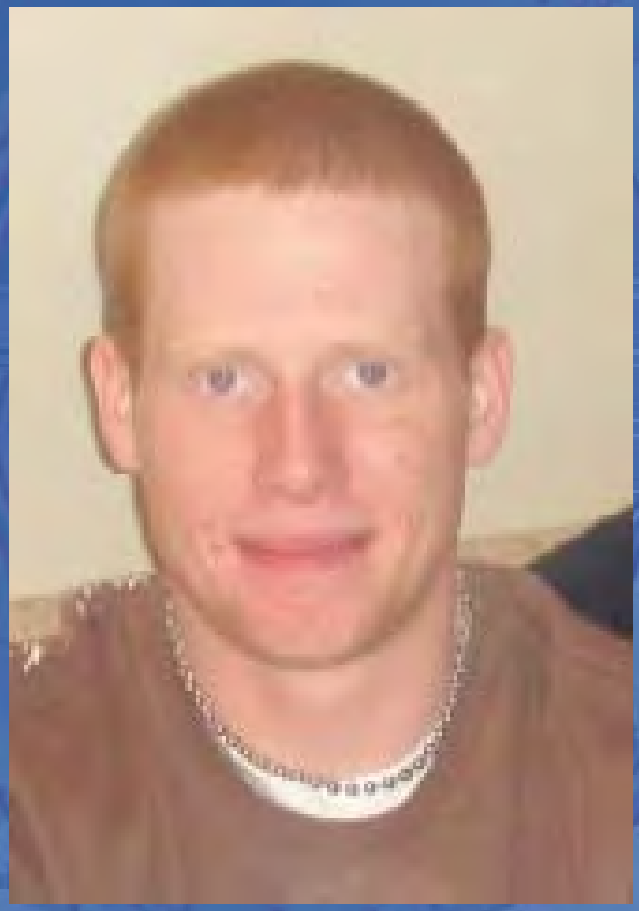
- The person standing in front of you at the airport

Kiosks

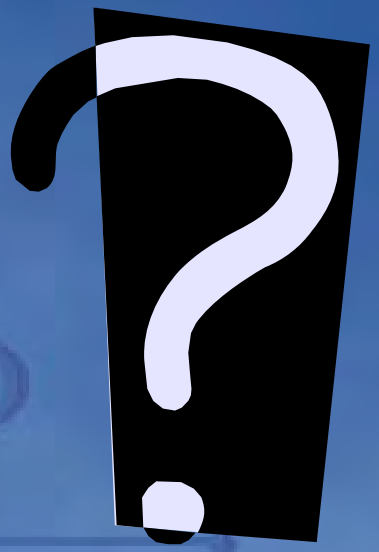
Checkpoint
Biometric
Checkpoint


Verification Checkpoint

Get the Probe Right !!!



Contact Information:



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