



Face Biometric Capture and Processing

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The Third Symposium and Exhibition on ICAO MRTDs, Biometrics and Security Standards

Travel Documents (1)

The Beginning

- Passports used for centuries to establish identity / to afford civil and diplomatic protection when crossing borders
- Passports took a variety of forms e.g. sovereign's letter of recommendation



The 1st Half of the 20th Century

- 1920, 1926: Conferences on standard passport and visa formats (layout, contents, validity, fees, format)
- 1946: Creation of ICAO



Travel Documents (2)

Role of ICAO

- ICAO's Mandate: Travel document recommendations, ...
- 1968: Establishment of a Panel on Passport Cards
- 1980: Panel published specifications and guidance material as first edition of Document 9303



Photo of the Holder's Face

- Universally accepted as a means of identification under privacy laws around the world
- Doc. 9303: Facial recognition shall become the globally interoperable biometric technology.



Travel Documents (3)

Machine Readable Passport

- Data page contains photo and biographical data
- Detailed recommendations in Doc. 9303, e.g. digital printing and portrait quality, size and location of photo



Electronic Passport - 1st Generation

- Basic Access Control / Passive Authentication
- Reader needs optical access to data page
- Today's standard (e.g. EU Member States)



Face Biometrics Application (1)

Federal Office for Administration

- National Visa Database / Operation 24 hours - 7 days
- Visa applications p.a.: 2,5 Mio. (2004)
- Full automated processing of 80 % of all applications



Database

- Storage of visa applicants photo and alphanumeric data
- Electronic transfer from diplomatic missions



Face Biometrics Application (2)

Example - Problems

- Visa application Hassan Mohamad
- Alphanumeric search yields 40 hits
 - (1) Hassan, Mohammad
 - (2) Hassan, Mohamed El Sayed
 - (3) Hassan, Mohammad Ahmad
 - (4) Hassan, Mohamed Helmy
 - (5) Hassan, Muhammad
 - ...
 - (40) Hassan, Jamil Mohamad



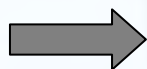
Face Biometrics Application (3)

Classification - Problems

- No hit – New file
- Same person – New data added to existing file
- Similar hit – Further action required



Hassan
Mohamad



(1)



Hassan
Muhammad

(2)



Hassan
Mohamed
El Sayed

(3)



Hassan
Mohammad

(4)



Hassan
Jamil
Mohamad

(5)



Hassan
Mohamed
Helmy

...



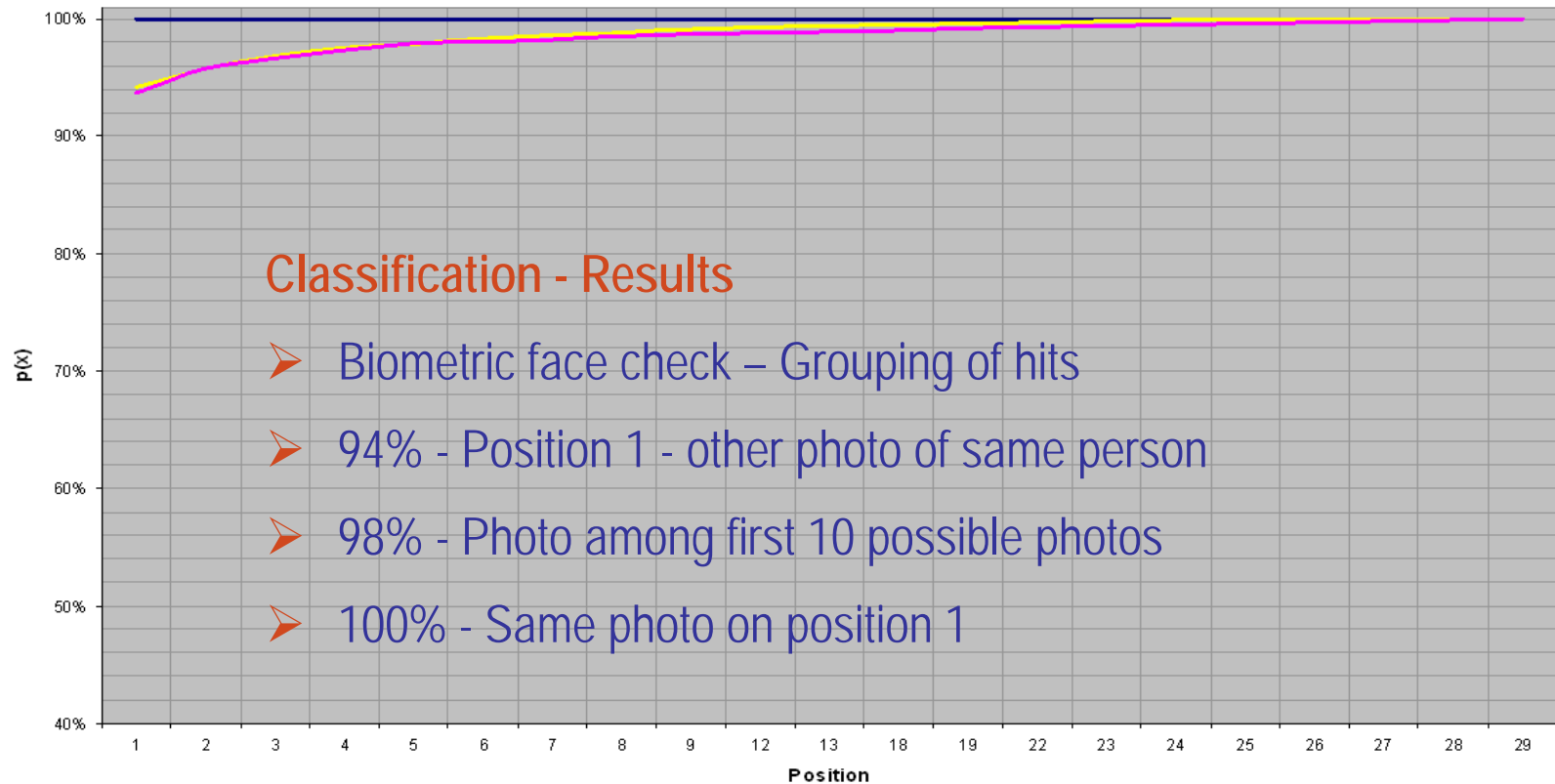
Face Biometrics Application (4)

Quality - Problems

- Distorted photograph, Low printing resolution, ...
- Reflecting glasses, distorted background, ...
- See guidelines for portraits in an MRP (Doc. 9303)

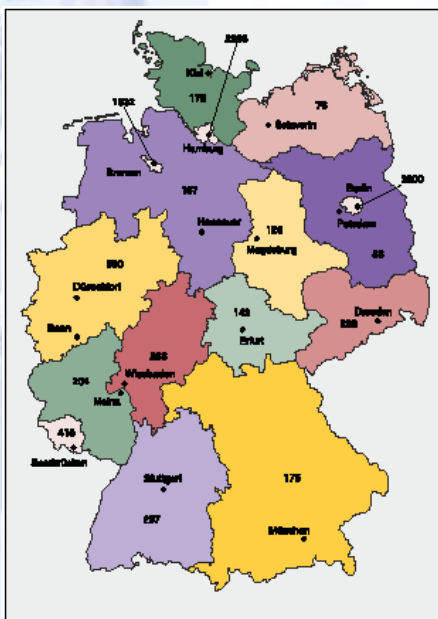


Face Biometrics Application (5)



Face Biometrics Application (6)

Example - National Visa Database



- Alphanumeric check – Number of similar hits
- Biometric face recognition – Grouping of hits
- Juridical, technical, organisational measures for protection of privacy; independent checks

Results

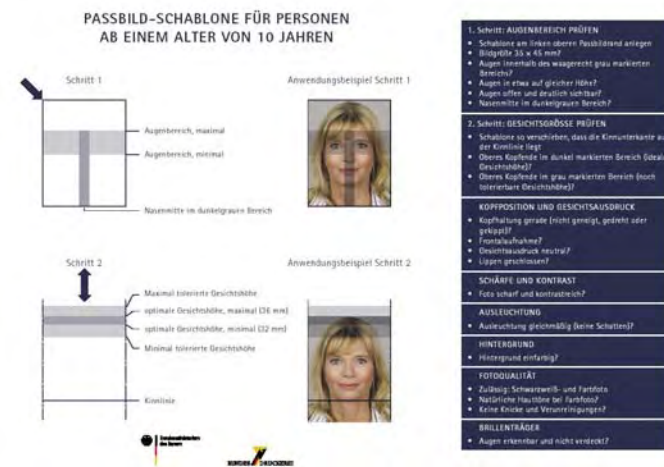
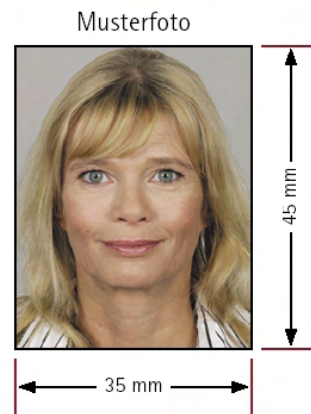
- Less human interaction
- Photos not necessarily ICAO compliant



ICAO Specifications in Practice (1)

Electronic Passport

- Photo scanned / taken at the time of application
- Communication campaign: Professional photographers; Manufacturers of Photo Cabins; Citizens



ICAO Specifications in Practice (2)

Electronic Passport

➤ Quality: Template / guidelines for portraits (Doc. 9303)



Brillenrahmen verdeckt Augen



Brillengläser zu dunkel



Spiegelung



Mit Hut



Gesicht verdeckt



Schatten im Gesicht



Zu groß



Zu klein



Nicht zentriert



Mund zu weit offen



Halbprofil



Kopfneigung



ICAO Specifications in Practice (3)

FotoCheck: Bewertungsergebnisse

Bewertungskriterium	Toleranzbereich	Ergebnis
✓ Dateiformat [Code]	(I): 1 (inkl.) - 2 (inkl.)	1
✓ Dateigröße [KiloBytes]	(I): >= 11.00	22.33
✓ Dateikompression [%]	(I): <= 97.50	96.52
✓ Farbraum [Code]	(I): 1 (inkl.) - 3 (inkl.)	1
✓ Farbtiefe [Bits pro Pixel]	(I): >= 8	24
✓ Bildbreite [Pixel]	(I): 390 (inkl.) - 460 (inkl.)	413
✓ Bildhöhe [Pixel]	(I): 510 (inkl.) - 580 (inkl.)	531
✓ Bildseitenverhältnis	(I): 0.65 (inkl.) - 0.90 (inkl.)	0.78
✓ Anzahl an gefundenen Gesichtern	(I): 1	1
✓ Anzahl an gefundenen Augen	(I): 2	2
✓ Augenabstand	(I): 90 (inkl.) - 400 (inkl.)	97
✗ Gesichtsmitte horizontal	(I): 0.48 (inkl.) - 0.52 (inkl.)	0.53
✓ Gesichtsmitte vertikal	(I): 0.40 (inkl.) - 0.50 (inkl.)	0.43
✗ Verhältnis Kopf- zu Bildbreite	(I): 0.5 (inkl.) - 0.71 (inkl.)	0.48
✗ Verhältnis Kopf- zu Bildhöhe	(I): 0.7 (inkl.) - 0.8 (inkl.)	0.55
✗ Kopfeigung oder -drehung [Grad]	(I): 0 (inkl.) - 1 (inkl.)	2

Hilfe... Schließen



Electronic Passport

- Software check mirrors majority of ICAO recommendations

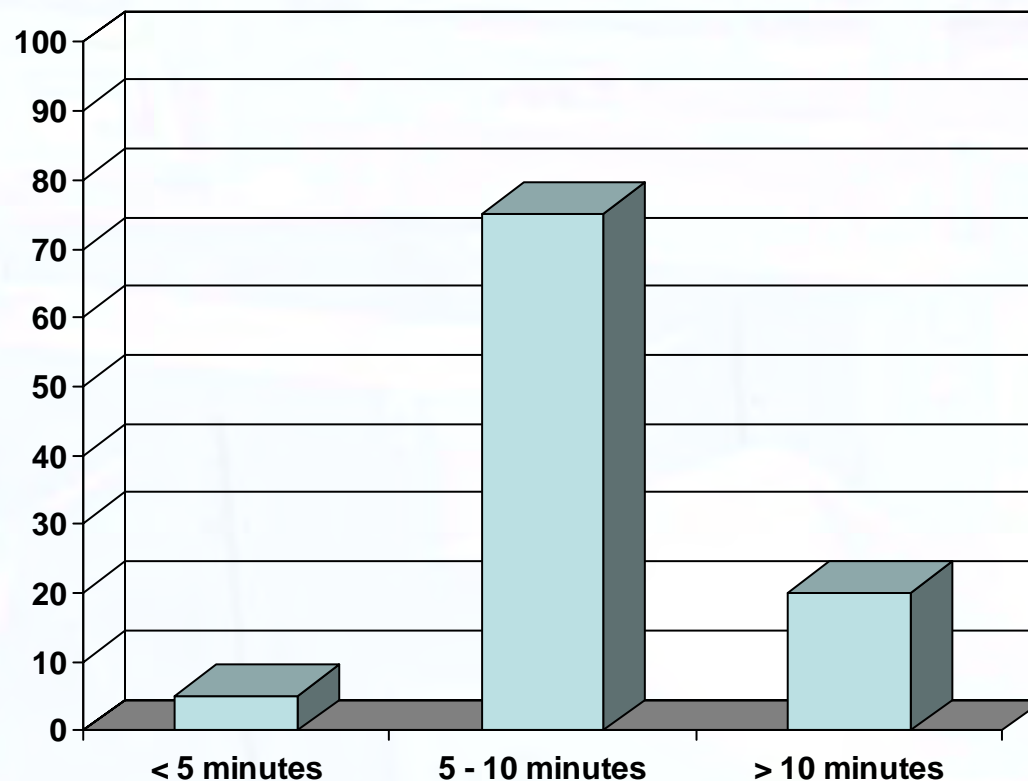
Phased Approach

- Citizen, Photographer, Passport Authority, Production
- Highest quality photo in electronic passport



ICAO Specifications in Practice (4)

How long do you need for one application process (face-to-face with the applicant)?



Face Biometrics in the EU

Visa Information System

- Legal basis largely agreed
- Technical preparations; Operation starts 1st half 2009



Biometrics

- VIS contains 10 fingerprints and photo of the applicant
- Checks for double application, identity fraud etc. on the basis of fingerprints
- Photo ICAO compliant
- Photo intended to support verification of identity at borders



Face Biometrics in the World (1)

Situation today

- Local or national applications
- Usually pre-registered trusted travellers
- Role of ICAO: Uniform regulations for photos



Facial Recognition

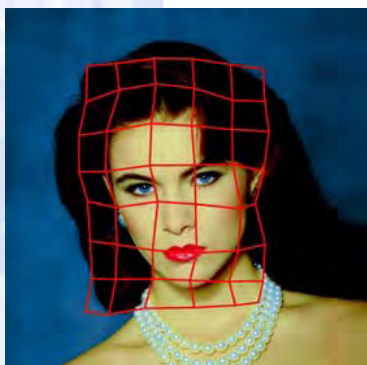
- Recognition technology significantly improved
1993: FRR 0.79 / FAR 0.1 ... 2007: FRR 0.01 / FAR 0.001
- Some applications / pilots based on ePassport photo
- Problems still exist, e.g. surveillance camera scenario



Face Biometrics in the World (2)

International

- International Conference of Data Protection & Privacy Commissioners – Global Data Protection Framework
- Biometrics:
 - Effective safeguards from early stage on
 - Strict distinction between purposes of collection / storage
 - Technical restriction for use in passports and ID cards



ICAO

- Face is assumed to be not privacy-sensitive
- Comply with data protection or privacy laws of issuing State



Face Biometrics in the World (3)

Protect RFID chip and data therein – Electronic Passport

- Doc. 9303: in-depth specification and security regulations
- Baseline Security:
 - Passive Authentication
- Advanced Security:
 - Comparison OCR-MRZ / LDS-MRZ
 - Active Authentication
 - Basic Access Control
 - Extended Access Control
 - Data Encryption



Face Biometrics Future (1)

Introduction

- EU Member States 2009 – ePassport of 2nd generation
- Schengen – 27 EU Member States / 3 non-EU States
- Border control – Growing number of signature / biometrics checks



Border Control in Germany

- Electronic passport enabled
- Pilots in preparation (2007 / 2008)
- Face recognition for border control (planned start in 2009)
- Automated border control lanes for registered travellers



Face Biometrics Future (2)

Problems at Enrolment

- Head size in the photo is sometimes too small or too big
- Application of the template is error-prone
- Determining the length of head might be difficult
- Rejection of images is frustrating for applicants

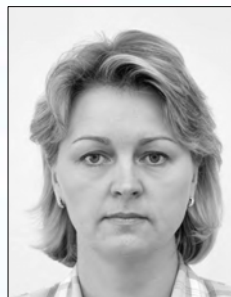


Conclusion

- Need to relax some tolerances for length and width of head
- NTWG to JTC1 / SC37 – ISO/IEC 19794-5 change on ballot (Biometric Data Interchange Format - Face Image Data)



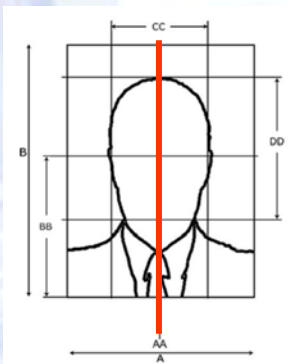
Face Biometrics Future (3)



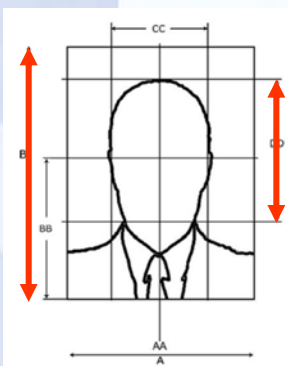
Face Biometrics Future (4)

Analysis / Result

4 countries; 1.000 – 2.200 real passport photos per country



- Relative horizontal position of head: Less than 20% fit ISO / ICAO standards



- Head image height ratio: About 60% fit ISO / ICAO standards



Face Biometrics Future (5)

Method

- Keep the nominal ranges of ISO/IEC 19794-5
- Slightly relaxed application of quality assurance software:
 - Define tolerances where missing or relax them
 - Keep pixel resolution between the eye centres unchanged

Result

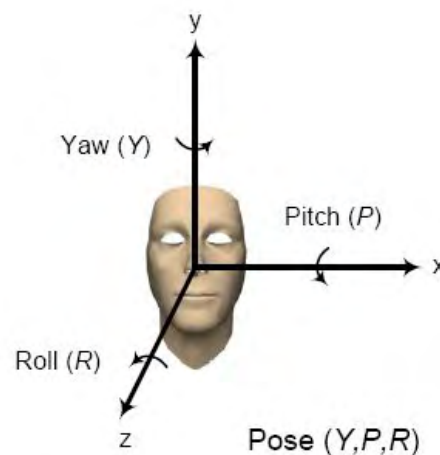
- 95% or more photos fit the standards
- Backward compatibility is preserved
- Degradation in facial recognition performance avoided
- Issuance process undisturbed



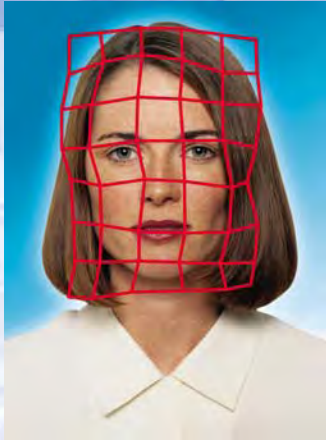
Face Biometrics Future (6)

Face 3D

- 3D face template generated
- Light grid enrolment of face (usually infrared)
- Variable yaw, pitch, roll (robust recognition)
- Comparison with 2D photo possible
- FRR=0.001 / FAR=0,005 / 1 sec.
- The future?



Summary



Face

- Universally accepted as a means of identification

Facial recognition

- ICAO: Globally interoperable biometric technology
- Growing importance due to eMRTD and border control
- Dynamic development: Performance, Robustness, 3D, ...
- Large scale applications exist: Proven added value
- Slight relaxation of tolerances (enrolment experience)





Thank you very much for your attention!

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