3D Face
Biometric Research

End-Users' Group Meeting
Berlin
21th of February 2008

3D Face EU research project:

Overview, progress and challenges
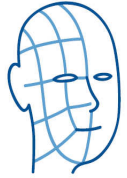
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Agenda

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- ■ **3DFACE background and motivation**

- ■ **Objectives and achievements**

- ■ **Remaining challenges**

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Background of the 3DFACE project

■ Electronic passport issued in Europe all contain a digitized facial image

■ 2D facial recognition needs to be improved with more robustness

■ **Unattended** border crossing can be achieved, only if additional (biometric) characteristics are observed

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Border Control Systems

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The 3DFACE project

- Integrated Project (FP6-026845)

  - 36 month project started April 2006

  - Research on 3D facial recognition to address needs of airports for processing biometric passports

- Consortium of 16 partners

  - Industry (Bundesdruckerei, Philips, Sagem, L1)

  - SMEs (Cognitec, Polygon)

  - Research Centres (Fraunhofer-IGD, CGC, CNR-IBB, JRC)

  - Universities (Kent, Twente, Darmstadt)

  - Operators (Airport Berlin, Airport Salzburg, BKA)

- **One particularity: competitive work on algorithm research**

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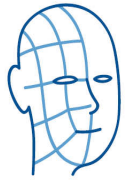
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Project objectives

- **3D face acquisition**

- **Explore multimodal facial data**

- **Biometric encryption techniques**

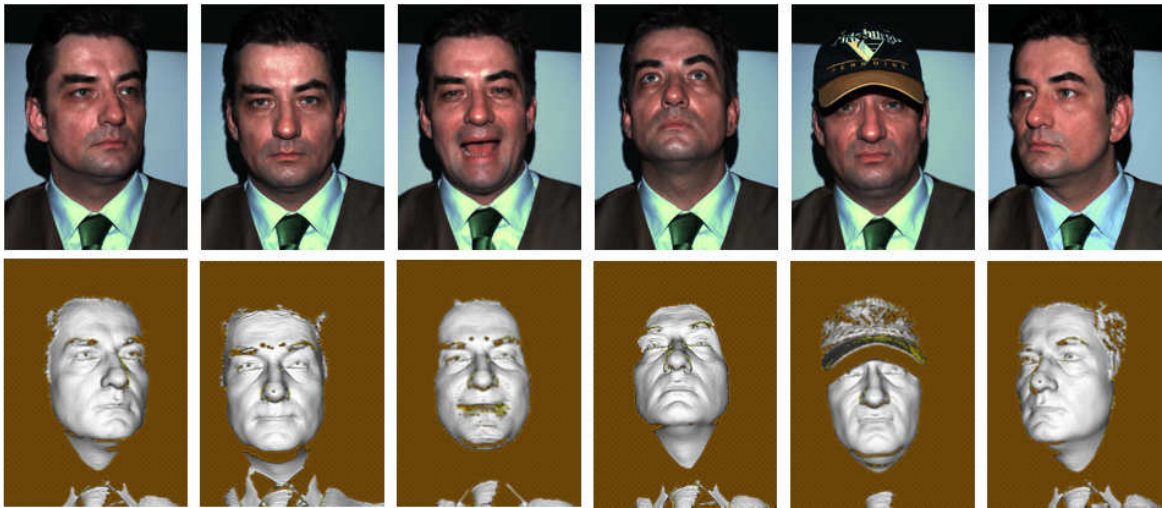- **Piloting at several locations**

- **Standardization**

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■ **3D face acquisition**

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■ Piloting at several locations

■ Standardization

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3D Face Biometric Research

- **3D and high-resolution 2D data**
- **Set-up of database with 600 subjects**
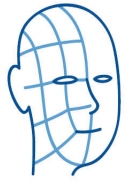
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3D face acquisition

- ■ **New device: automatic height adjustment**

- ■ **Will used in the pilot phases**
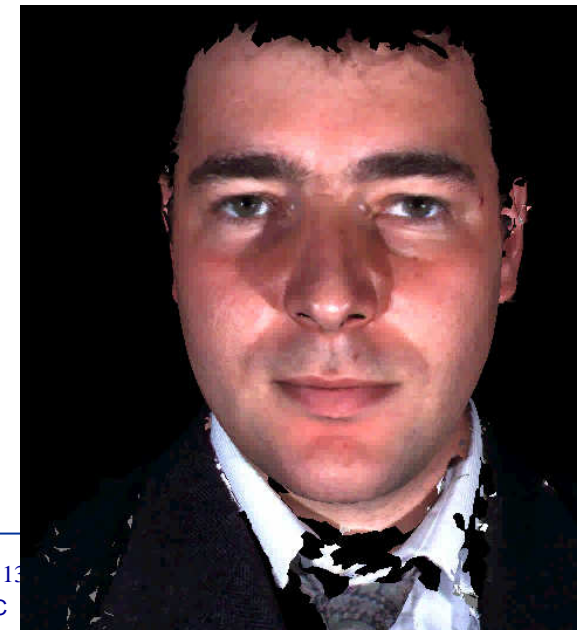
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Project objectives

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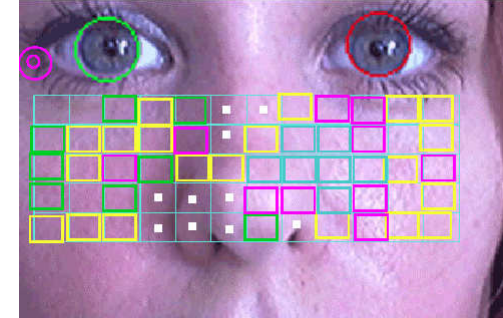
- 3D face acquisition

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- **3D, 3D+2D**
- **Skin texture**
- **Multiple algorithms**
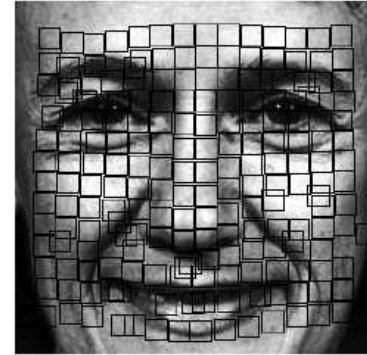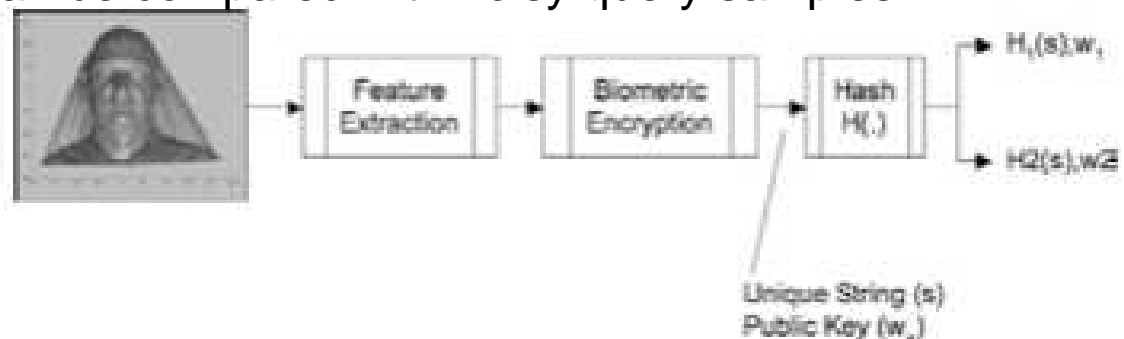- **Score level fusion**
- **Decision level fusion**

Project objectives

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Biometric encryption techniques

■ Highest degree of protection for stored data

- ● Enable templates to be stored in encrypted form
  - ♦ comparison without decryption
- ● Enable revocability of biometric references
  - ♦ create new templates from the same sample
- ● Avoid Cross-Comparison between databases
- ● Avoid Medical Relevant Information

■ Challenge: Noise-robustness

- ● Stored information can be compared with noisy query samples
- ● Fuzzy extractors

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Project objectives

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Piloting at several locations

- Improve biometric performance in an operational environment

  - Internal competition of labs before validation at airportsand at BKA

  - Selection of best combination by independent evaluation

- Validation phase

  - Start in July 2008

  - Berlin Schönefeld Airport, Salzburg Airport, BKA location

  - Dedicated to frequent users (area access control)

  - Operational performance

  - Social and operational issues

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Acceptance issues in the project: Privacy

■ **Dedicated work on cross-juridictional and ethical issues in general (CNR)**

■ **… But also operational issues**

- ● **Data collection for algorithm design and testing (600 enrolees in France Germany and UK)**

- ● **Data from real users is used during the fiel tests**

- ● **Protocol to deal with privacy issues**

    - ♦ **Data collected from volonteers only**

    - ♦ **« anonymous » facial data (NOT the name, occupation, etc.) are kept**

    - ♦ **Information of the volonteers**

    - ♦ **Commitment on the confidentiality of these data used for research purpose in the frame of the project only.**

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Acceptance issues in the project: Privacy

● **Differences from one country to another**

  ♦ **UK: ethics commitee of the partner**

  ♦ **Germany: legal department**

  ♦ **France: official request to the national privacy commission (CNIL)**

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Acceptance issues in the project: Safety

- **the camera developped for 3D acquisition has an illumination device**

- **it was legitim to require some proofs that the system was no danger for health**

- **theoretical calculation and real measurements have been performed:**

  - **Visible illumination**

  - **maximum exposure time**

  - **minimum distance to the device**

  were very compatible with the use of the device (factor 10 for the worse case)

- **For the tests on the field, formal documents are produced (CE certification, compliance with ISO standard)**

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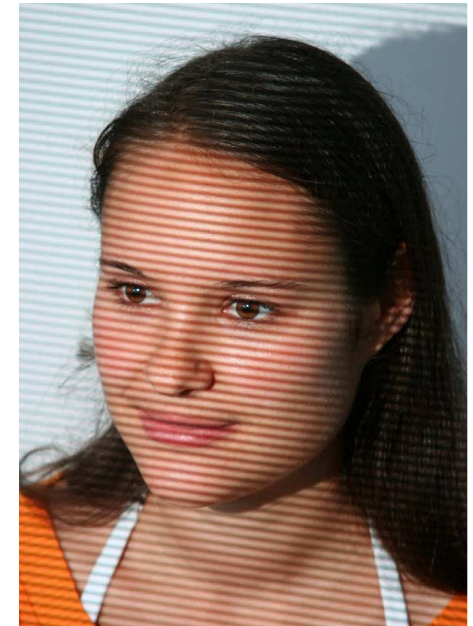
Achievements

■ **First results in each research field**
- Innovative 3D acquisition sensors
- Novel 3D and 2D algorithms
- New approaches on face texture analysis
- A unique multimodal face database available
- Advanced techniques for facial template protection, implemented on state-of the-art algorithms

■ **First platform available for testing:**
- Algorithm test protocol and platform running at Fraunhofer-IGD
- Intependant of the "developers"

■ **First integration of each component in a full prototype**
- component approach + fusion: flexibility for combination and update of the algorithms
- first version ready for demonstration at the M24 review

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Challenges

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- ■ **Obtaining the best algorithm combination for the field tests in 2008**
  - ● intensive offline tests and algorithm improvement

- ■ **Be able to show the robusteness and accuracy gain linked to the use of 3D facial recognition**

- ■ **Evaluate attack scenarios (spoofing) and design liveness tests (countermeasures)**

- ■ **Standards: provide the community (ISO/SC37, ICAO) with recommandation**
  - ● trade-off between size of the record and accuracy for compact storage unit
  - ● height of the person would be usefull in the chip

- ■ **Obtaining a realistic operational evaluation**
  - ● participation of a large number of end-users
  - ● several sessions for earch enrolee
  - ● offline replay with several configurations

- ■ **Analyse end-users feedbacks when using the system**
  - ● Comfort ? Ergonomics ?
  - ● Intrusiveness ? Privacy concerns ?
  - ● Gain for the user ?

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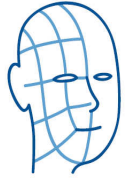
Conclusion

3DFACE domain is increasing in importance

- ♦ recent NIST report FRVT2006

- ♦ report on template protection techniques from Privacy Information Commission, Canada

$\Rightarrow$ **critical importance of the 3DFACE project's mission**