Biometric Research in Darmstadt

Christoph Busch

da/sec @ Hochschule Darmstadt

https://christoph-busch.de
http://www.dasec.h-da.de

2025-10-01

da /sec BIOMETRICS & SECURITY RESEARCH GROUP

h_da hochschule darmstadt

eut+ EUROPEAN UNIVERSITY OF TECHNOLOGY

ATHENE

Lectures offered by da/sec

Lectures in WS and SS

We offer the following lecture in the current winter term

- https://dasec.h-da.de/category/teaching/lectures_current

ADVANCED SEMINAR / MASTERSEMINAR WS 2025/26

📄 30. September 2025   👤 Christian Rathgeb   📁
Current Lectures, Teaching

The Advanced Seminar will focus on different topics related to Identity Science, in particular on how to reliable recognize people

Weiterlesen »

Biometrics and Security Research Group
da/sec

IT-Security in Darmstadt

National Research Center for Applied Cybersecurity (ATHENE)

- **400+ scientist** from 47+ countries

TECHNISCHE UNIVERSITÄT DARMSTADT — CYSEC research group at TU Darmstadt — CYSEC Cybersecurity TU Darmstadt

Fraunhofer SIT — Fraunhofer Institute for Secure Information Technology SIT

Fraunhofer IGD — Fraunhofer Institute for Computer Graphics Research IGD

h_da HOCHSCHULE DARMSTADT UNIVERSITY OF APPLIED SCIENCES — da/sec research group at Hochschule Darmstadt — da/sec BIOMETRICS & SECURITY RESEARCH GROUP
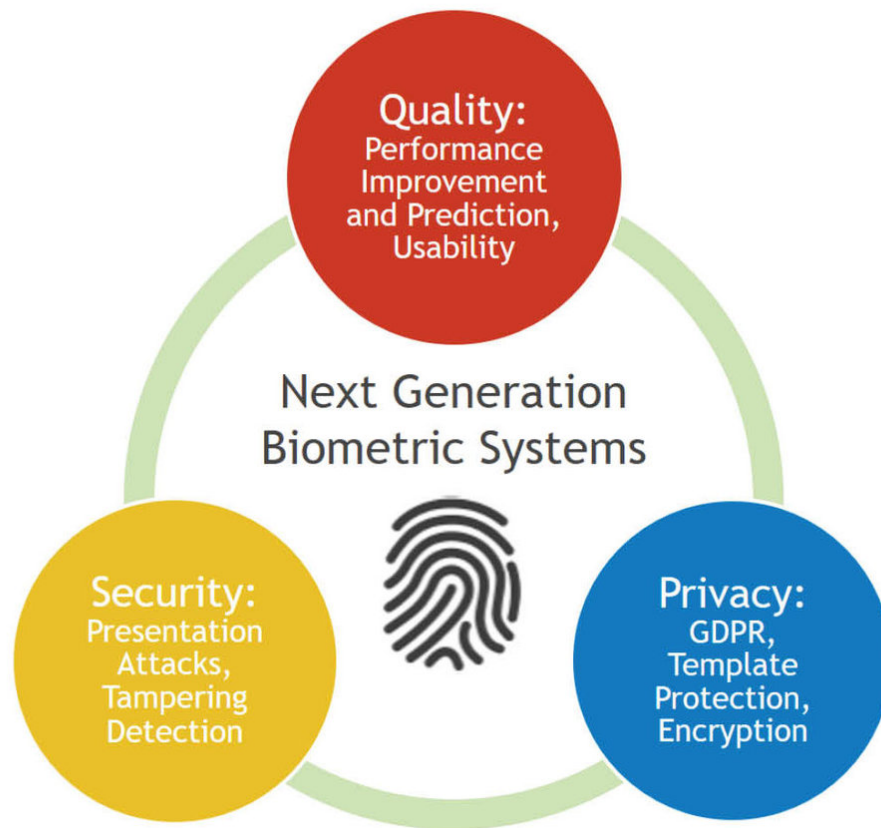
GOETHE UNIVERSITÄT FRANKFURT AM MAIN — GU Frankfurt

IT-Security in Darmstadt

National Research Center for Applied Cybersecurity (ATHENE)

- **25 scientist** working on biometrics from HDA and Fraunhofer IGD

https://ngbs.athene-center.de/

Research Team

da/sec - Biometrics and Internet-Security Research Group

- Faculty-Members / PostDocs:
  - Christoph Busch
  - Christian Rathgeb
  - Juan Tapia
  - Janier Soler
- PhD-Students / Lab-Engineers:
  - Ana Real
  - Andre Dörsch
  - Daniel Fischer
  - Fabian Stockhardt
  - Florian Bayer
  - Gregor Grote
  - Hans Geißner
  - Robert Nichols
  - Torsten Schlett
  - Philipp Schock

2024

- Key-factors - since 2009:
  - 8 European funded projects,
    10 German funded projects
    5 research projects funded by the German BSI,
    2 industrial projects,
  - cooperated with > 30 research partners
  - more than 700 peer-reviewed publications

EU Projects

History of EU-Projects @ HDA

Project Series

FIDELITY

2012-02 to 2016-01

https://christoph-busch.de/projects-fidelity.html

SOTAMD

2019-02 to 2020-01

https://christoph-busch.de/projects-sotamd.html

iMARS

2020-09 to 2024-11

https://christoph-busch.de/projects-iMARS.html

EINSTEIN

2024-01 to 2026-12

https://christoph-busch.de/projects-EINSTEIN.html

CarMen

2024-09 to 2027-08

https://christoph-busch.de/projects-CarMen.html

Biometric research

- Covering various biological biometrics:
  - ▸ 2D- and 3D-face recognition,
  - ▸ fingerprint recognition,
  - ▸ iris and periocular recognition,
- Focus on
  - ▸ biometric template protection
  - ▸ presentation attack detection
  - ▸ morphing attack detection

T_{mail}

Santander CONSUMER BANK T_{bank}

Employer T_{job}

$T_{facebook}$

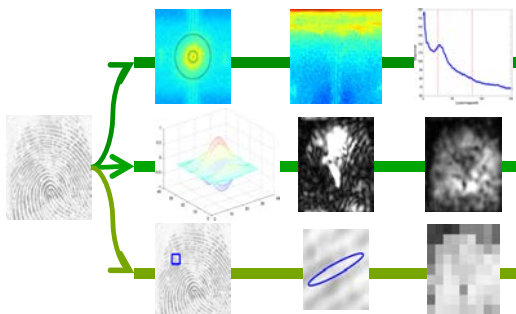$T_{linkedin}$

Same subject??
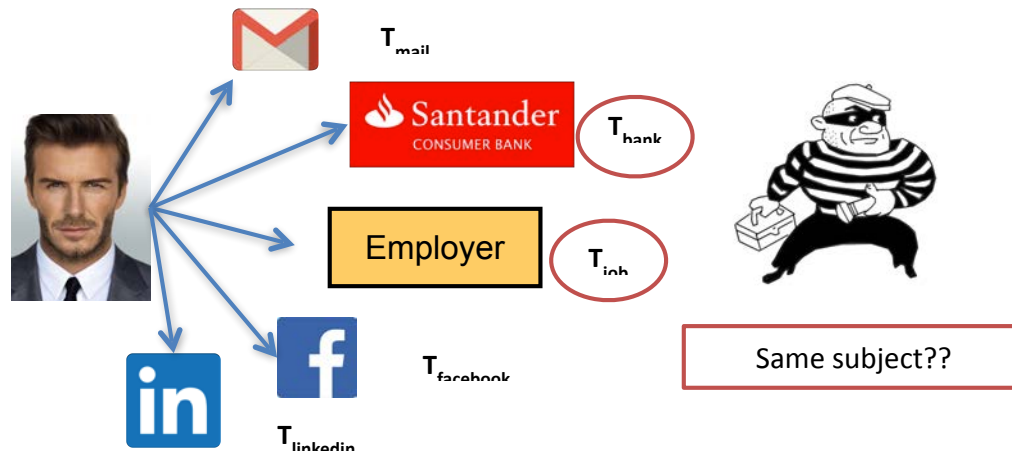
Application Oriented Research

Fingerprint Image Quality Assessment

NFIQ2.0

- Performance improvements can be achieved by improving data quality of biometric references.

- Measure quality by filtering the signal and determine the utility of a fingerprint sample.

character   behavior   environment   Imaging/system

- Research results constitute the content of ISO/IEC 29794-4

http://www.christoph-busch.de/projects-nfiq2.html

Quality Metrics for Fingerprint Images

NFIQ2.0

- Is this (ISO/IEC 29794-4) a relevant standard?

- YES - the Entry Exit System implementing decision 2019/329 defines the mandatory use:

- *„At the moment of enrolment,
  the version 2.0 (or newer version)
  of the Fingerprint Image Quality (NFIQ)
  metric …. shall be used for verifying
  that the quality of the captured fingerprint
  data respects the thresholds …"*

http://www.christoph-busch.de/projects-nfiq2.html

Image Quality in the EU Entry Exit System

The objective in the EES implementing decision 2019/329

- *„The quality of the facial images, … and with the image requirements of ISO/IEC 19794-5:2011 Frontal image type"*

What does that mean?

Data subjects need actionable feedback

- If quality is poor, then what went wrong?

INTERNATIONAL STANDARD — ISO/IEC 19794-5

Second edition 2011-11-01

Information technology — Biometric data interchange formats —

Part 5: Face image data

Technologies de l'information — Formats d'échange de données biométriques —

Partie 5: Données d'image de la face
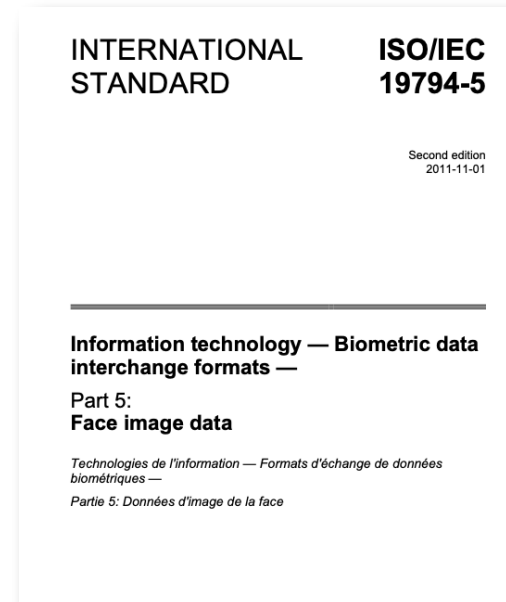
| Compliant image | Pose | Eyes open | Mouth open | Inhomogenous background |

Source: ISO/IEC 39794-5

ISO/IEC 29794-5: Face Image Quality

Standardize and develop quality measures

- https://www.iso.org/standard/81005.html
- https://github.com/BSI-OFIQ/OFIQ-Project
- https://christoph-busch.de/projects-ofiq.html
- **Unified** quality **score**
- **Capture-related** quality measures
- **Subject-related** quality measures
- Contribution from our research:
  - ‣ Quantify **expression** neutrality

a) Compliant image   b) Low contrast

source: ISO/IEC 39794-5:2019, Annex D
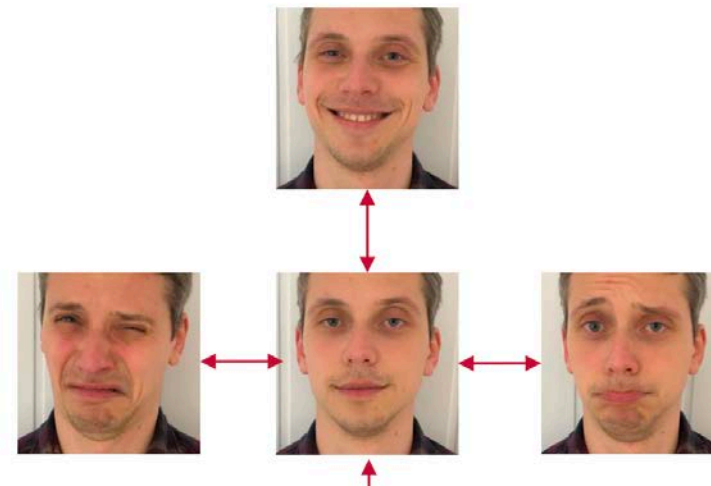
[GRVB2023] M. Grimmer, C. Rathgeb, R. Veldhuis, C. Busch: "NeutrEx: A 3D Quality Component Measure on Facial Expression Neutrality", in Proceedings of International Joint Conference on Biometrics (IJCB), (2023)

[GVB2024] M. Grimmer, R. Veldhuis, C. Busch: "Efficient Expression Neutrality Estimation with Application to Face Recognition Utility Prediction", in Proceedings of 12th International Workshop on Biometrics and Forensics, (2024)

Face Image Quality - Future work

Open research tasks for OFIQ 2

- Further innovation of quality measures

- Add missing components (e.g. motion blur)

- Investigate demographic variability

  ‣ Unified quality score distributions across MST 10 skin tone scale
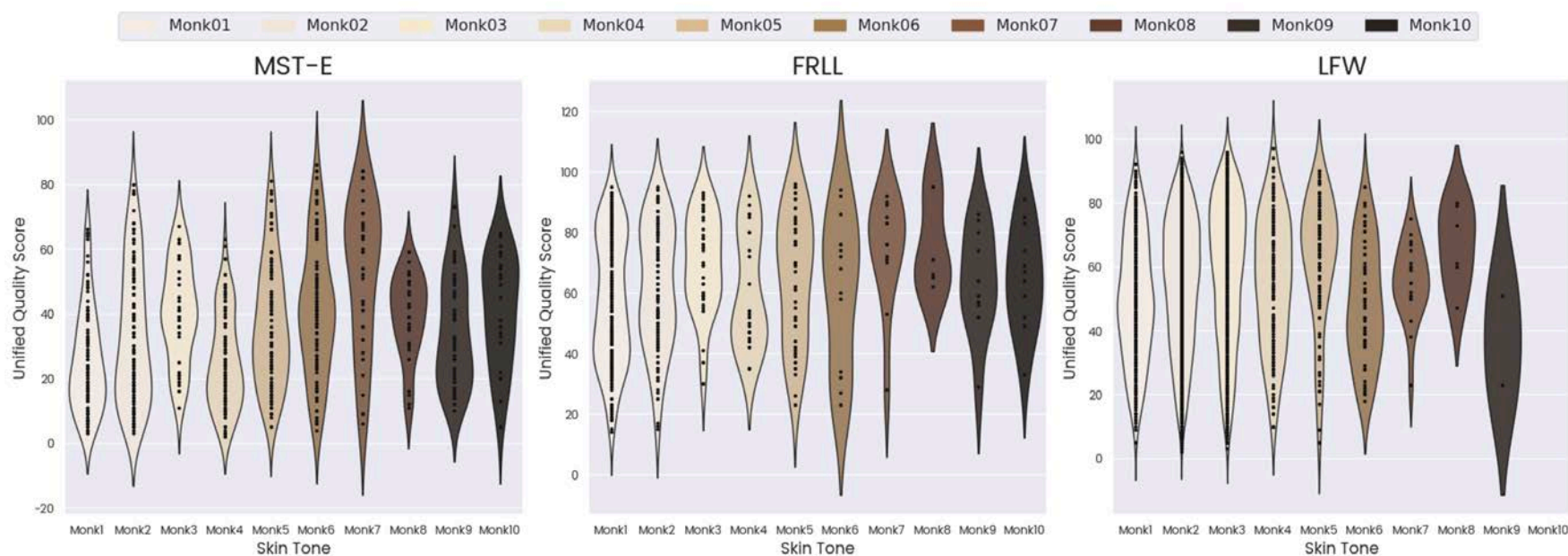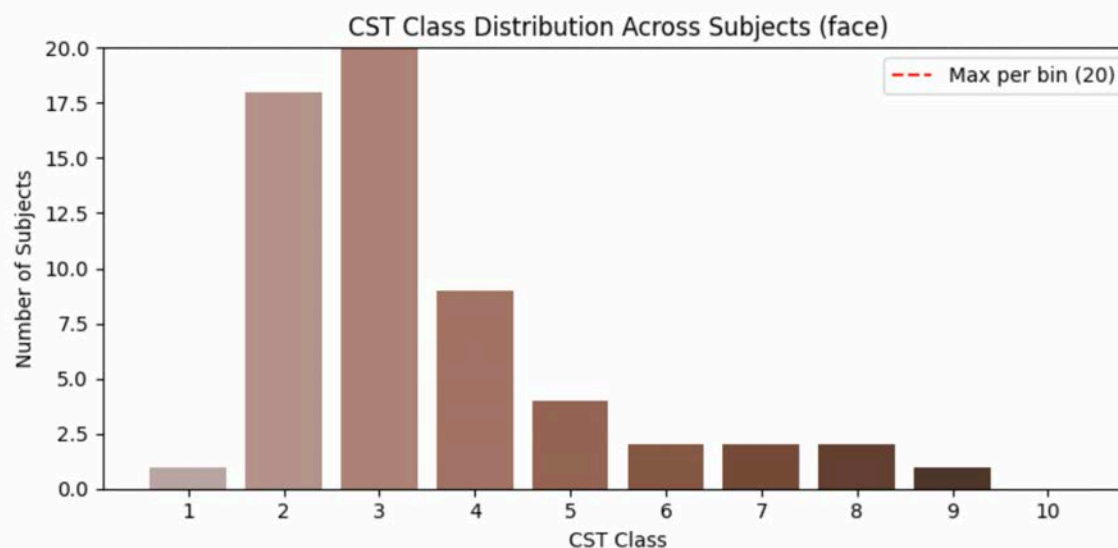

[KRRB2024] W. Kabbani, K. Raja, R. Raghavendra, C. Busch: "Demographic Differentials in Face Image Quality Measures", in Proceedings of the IEEE 23rd International Conference of the Biometrics Special Interest Group (BIOSIG), Darmstadt, September 25-27, (2024)

Face Image Quality - Future work

Darmstadt Skin Tone Database

- https://dasec.h-da.de/research/biometrics/hda-passport-fairness-database/

Aktuelle Verteilung der Teilnehmer nach Hauttyp (CST):

CST Class Distribution Across Subjects (face)

Hauttyp-Einteilung nach CST:

European Association for Biometrics (EAB)
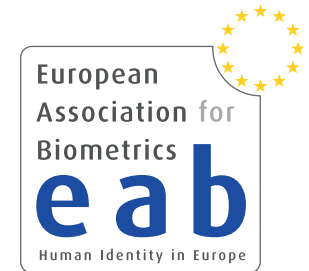
Objectives of the EAB

- The EAB is a non-profit,
  nonpartisan association
  https://eab.org/

- EAB supports all sections of the
  ID community across Europe,
  including governments,
  NGO's, industry, associations
  and special interest groups
  and academia.

- Our role is to promote the responsible use and
  adoption of modern digital identity systems
  that enhance people's lives and drive economic growth.

- Free membership for Bachelor, Master and PhD students!
  https://eab.org/membership/types_of_membership.html

European Association for Biometrics (EAB)

More Information

- Our initiatives are designed to foster networking

  ▸ annual conference: EAB-RPC
    https://eab.org/events/program/300

  ▸ research awards
    https://eab.org/award/hall_of_fame.html

  ▸ workshops on relevant topics (e.g. Presentation Attack Detection, Morphing Attack Detection, Sample Quality, Bias in Biometric Systems)
    https://eab.org/events/

  ▸ lunch talks
    https://eab.org/events/program/324

  ▸ recorded keynote talks
    https://eab.org/events/lectures.html

  ▸ monthly newsletter
    https://eab.org/news/newsletter.html

  ▸ annual academic graduation report
    https://eab.org/information/documents.html

  ▸ open source repository
    https://eab.org/information/software.html

Contact

ATHENE
National Research Center
for Applied Cybersecurity

h_da
HOCHSCHULE DARMSTADT
UNIVERSITY OF APPLIED SCIENCES

Prof. Dr. Christoph Busch
Principal Investigator

Hochschule Darmstadt FBI

Schöfferstr. 3
64295 Darmstadt, Germany
christoph.busch@h-da.de

Telefon +49-6151-533-30090
https://dasec.h-da.de

https://www.athene-center.de