Biometric Sample Quality with ISO/IEC 29794

2026-06-25
IEG General Annual Meeting

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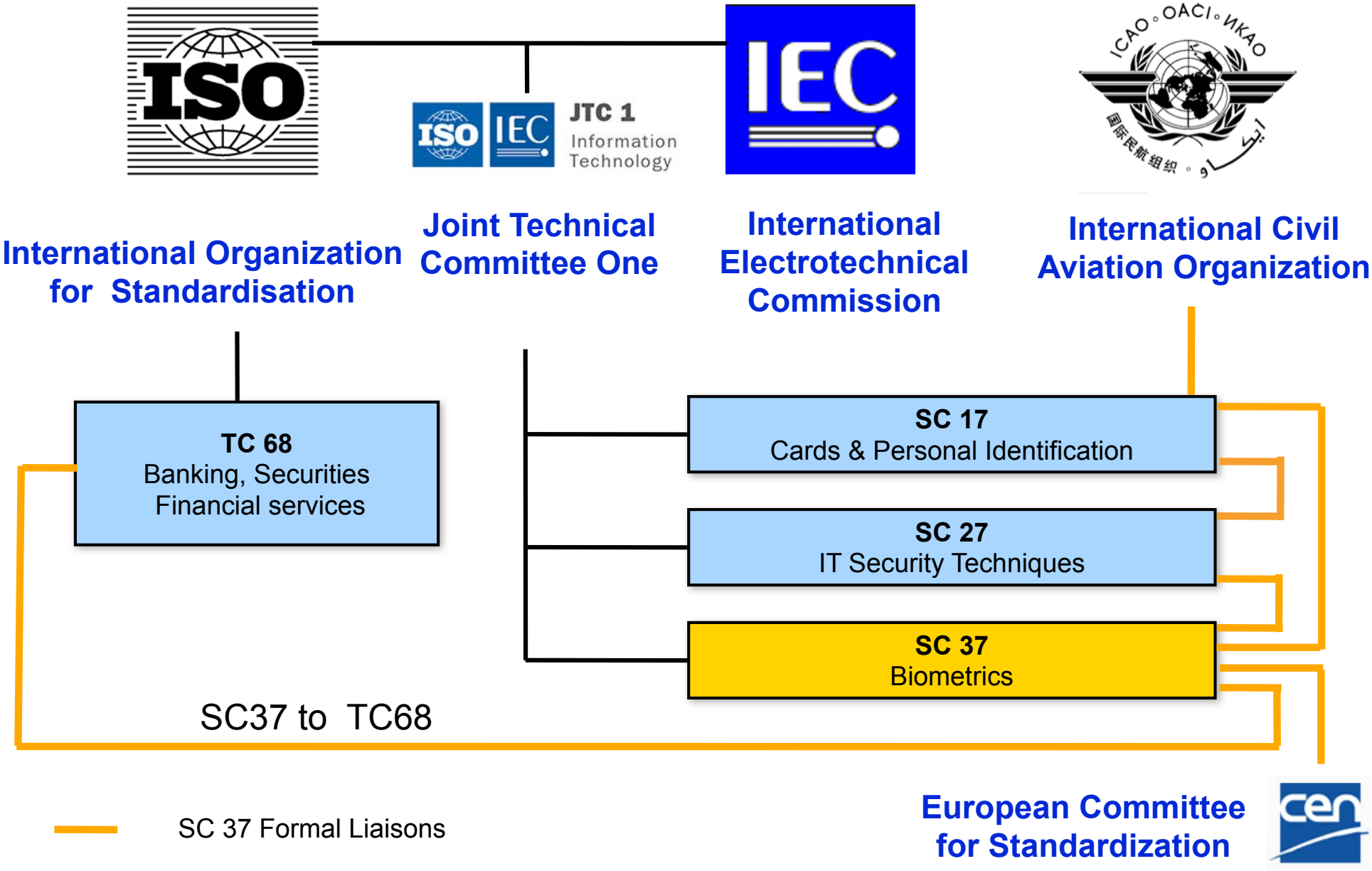
copy of slides available at:
https://christoph-busch.de/about-talks-slides.html

ATHENE / Hochschule Darmstadt, Germany

ATHENE

European Association for Biometrics
eab
Human Identity in Europe

Biometric Standardisation in ISO/IEC



ISO/IEC SC37 Biometrics

Established by JTC 1 in June 2002 to ensure

- a high-priority, focused and comprehensive approach worldwide for the rapid development of formal generic biometric standards

Scope of SC37

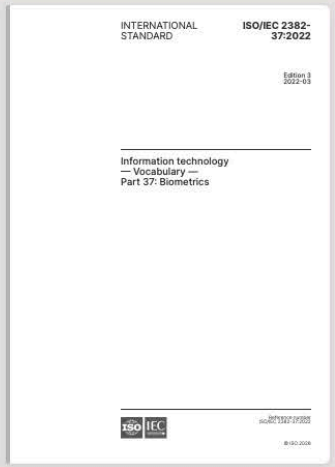
- *"Standardization of generic biometric technologies pertaining to human beings to support interoperability and data interchange among applications and systems. Generic human biometric standards include: common file frameworks; biometric application programming interfaces; biometric data interchange formats; related biometric profiles; application of evaluation criteria to biometric technologies; methodologies for performance testing and reporting and cross jurisdictional and societal aspects"*
- http://www.jtc1.org

Next meeting: July, 2026 in Copenhagen

Relevant Standards

Biometric Vocabulary

Standards Sectors About ISO Insights & news Taking part



Read sample

← TC ← ISO/IEC JTC 1/SC 37

ISO/IEC 2382-37:2022

Information technology — Vocabulary

Part 37: Biometrics

Published (Edition 3, 2022)

https://www.iso.org/obp/ui/en/#iso:std:iso-iec:2382:-37:ed-3:v1:en

Biometric Sample Quality

Factors impacting Quality

Defects caused by the capture device

- Image capture device out of focus
- Sampling error, low contrast for fingerprints

Defects caused by the capture subject‘s behaviour

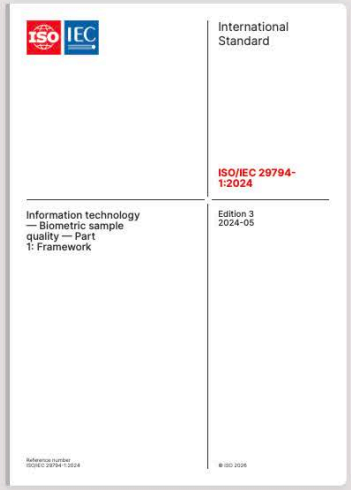
- No frontal perspective
- Elastic deformation
- Improper finger placement (too low, rotated, etc)
- Defect caused by the source
  - Skin condition such as moist, oily, dry and so on
  - Scars, wrinkles, blisters, eczema, dirt

If poor quality is known,
constructive feedback should be provided (actionable quality)

Relevant Standards

Biometric sample quality - Framework

ISO Standards Sectors About ISO Insights & news Taking part Store



Read sample

← TC ← ISO/IEC JTC 1/SC 37

ISO/IEC 29794-1:2024

Information technology — Biometric sample quality

Part 1: Framework

Published (Edition 3, 2024)

https://www.iso.org/standard/79519.html

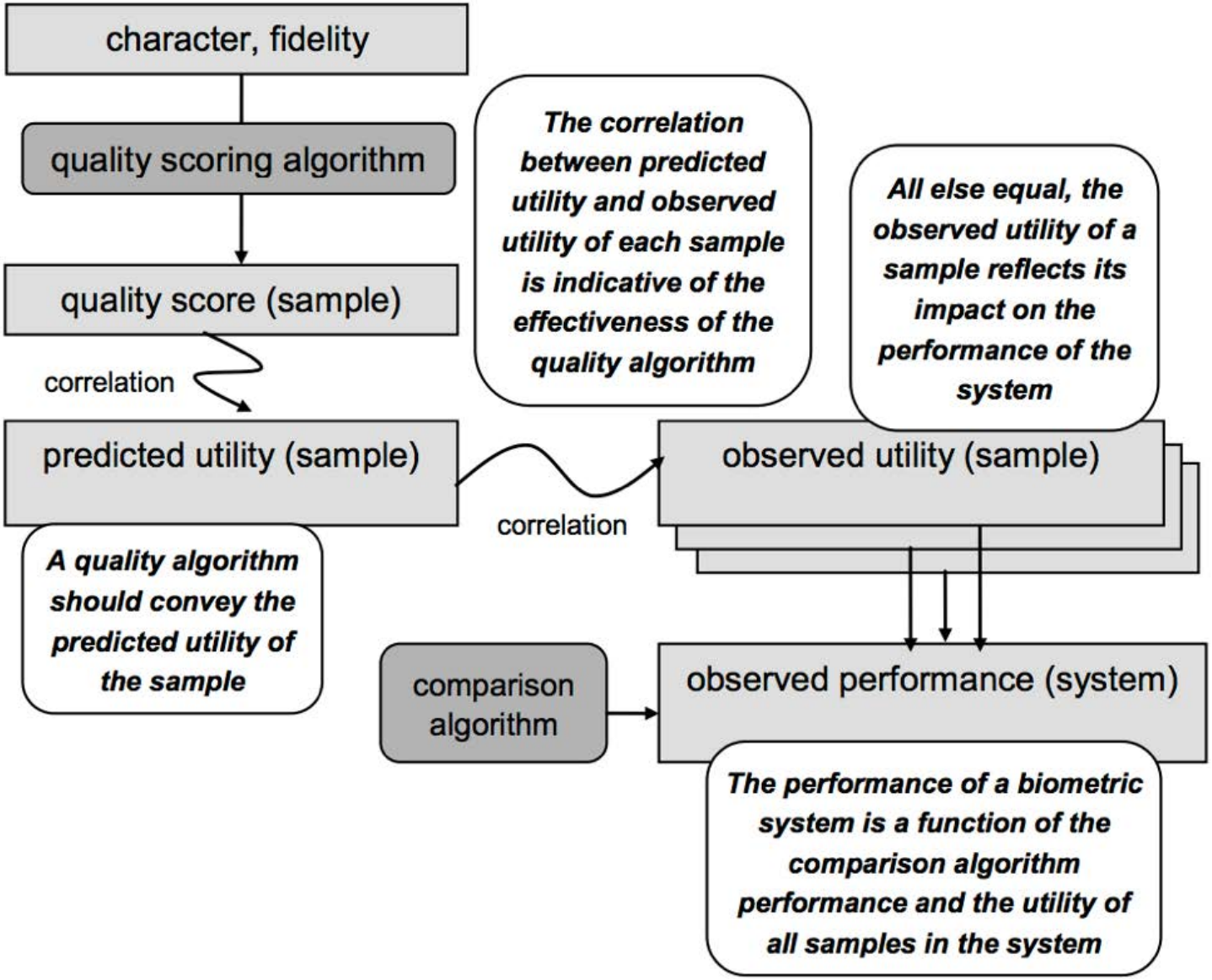
Factors impacting Quality

What is reflected by „quality“

- Character of a sample
  - Expression of quality based on the inherent properties of the source from which the biometric sample is derived.
  - For example, a scarred fingerprint has a poor character
- Fidelity of a sample to the source from which it is derived
  - Expression of quality based on fidelity reflects the degree of its similarity to its source.
  - For example sensor quality, noise related to capture process
- Utility of a single sample within a biometric system.
  - Expression of quality based on utility reflects the predicted positive or negative contribution of an individual sample to the overall performance of a biometric system.
  - Is there valuable biometric information in the sample?

Quality and Performance

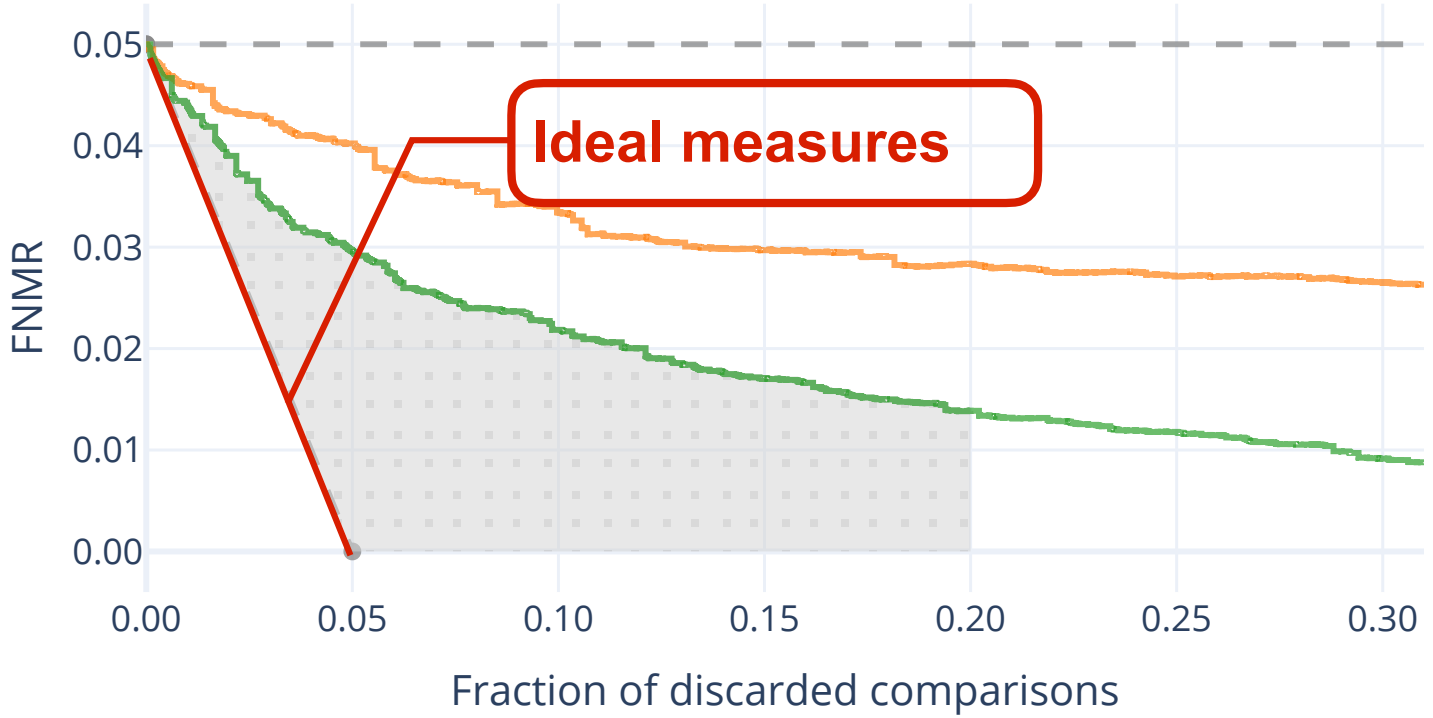
Relationship between quality and system



Evaluation of Predictability

Error versus reject/Discard Characteristic curve (EDC)

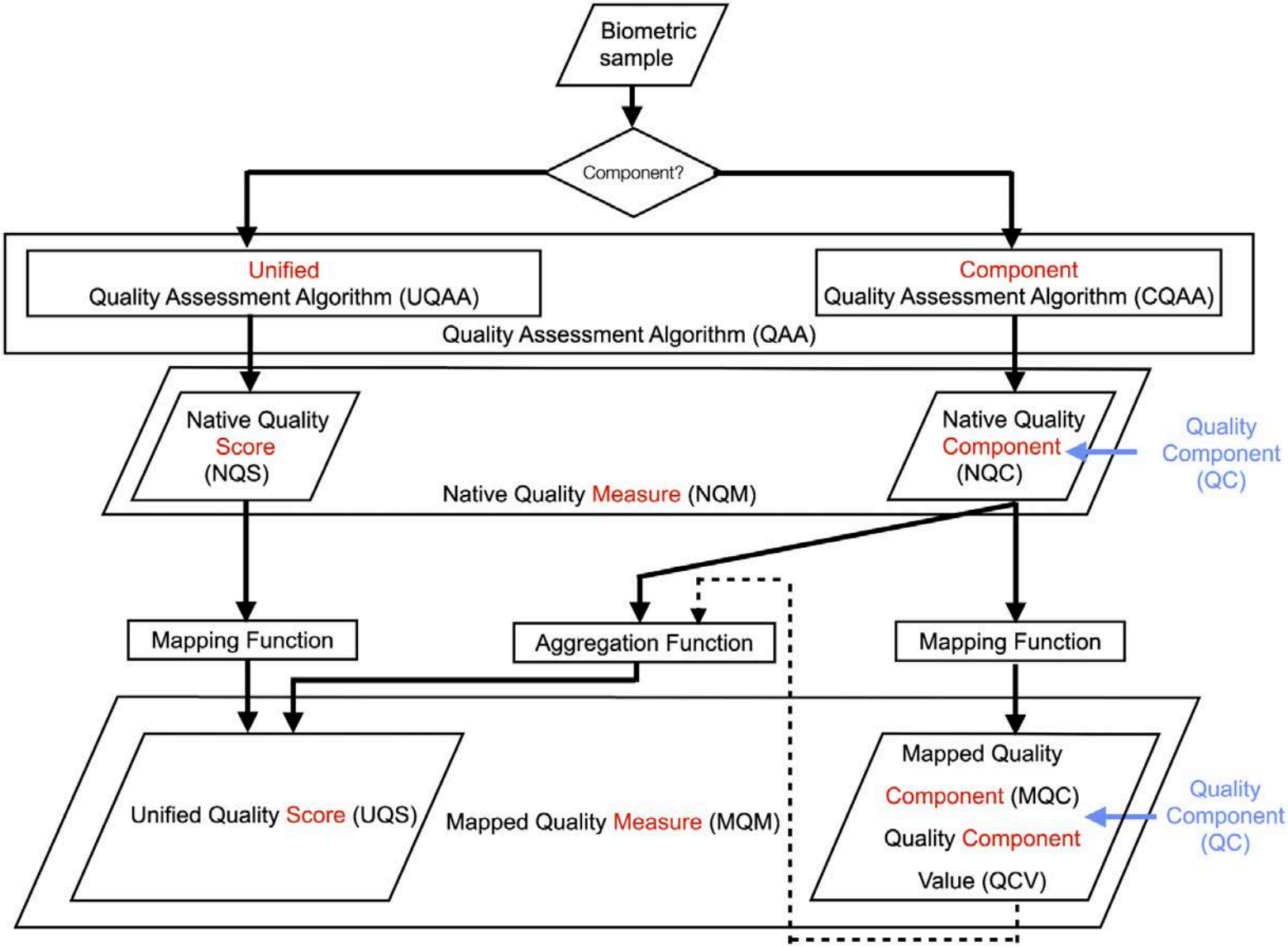
- Stronger decrease of the EDC curve indicates a better prediction, meaning really the poorest samples are out



- Report the partial area under curve (pAUC) in the range 0 to 0,2

Quality Measures - Framework Standard

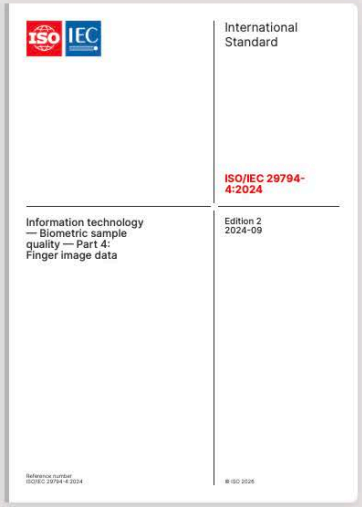
Holistic approach versus aggregation



Relevant Standards

Biometric sample quality - Finger image data

ISO Standards Sectors About ISO Insights & news Taking part Store



Read sample

← TC ← ISO/IEC JTC 1/SC 37

ISO/IEC 29794-4:2024

Information technology — Biometric sample quality

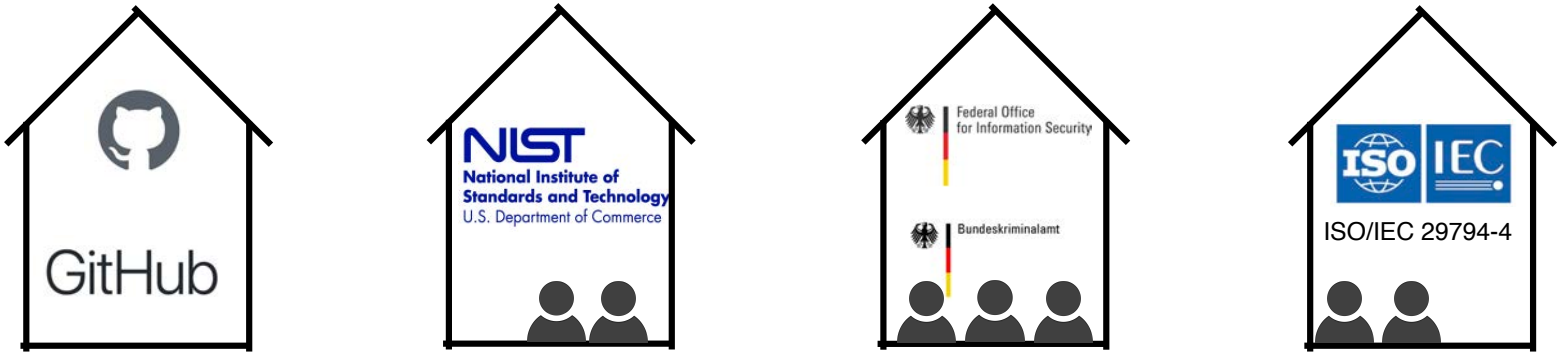
Part 4: Finger image data

Published (Edition 2, 2024)

https://www.iso.org/standard/83827.html

Quality Measures for Fingerprint Images

How was NFIQ2.0 developed?



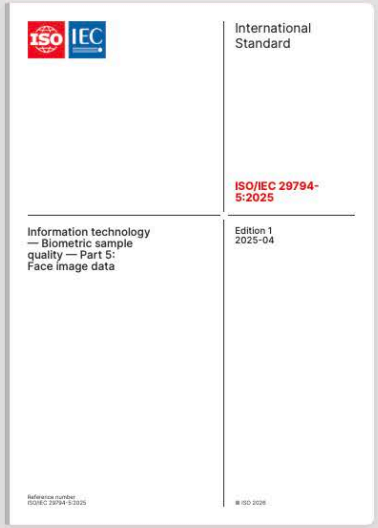
Maintenance | Testing | Development | Standardisation

- Status 2026
  - NFIQ2.3 in GitHub: https://github.com/usnistgov/NFIQ2
  - ISO/IEC 29794-4: https://www.iso.org/standard/83827.html
  - Active AdHoc-Group preparing the next edition

Relevant Standards

Biometric sample quality - Face image data

ISO Standards Sectors About ISO Insights & news Taking part Store



Read sample

← TC ← ISO/IEC JTC 1/SC 37

ISO/IEC 29794-5:2025

Information technology — Biometric sample quality

Part 5: Face image data

Published (Edition 1, 2025)

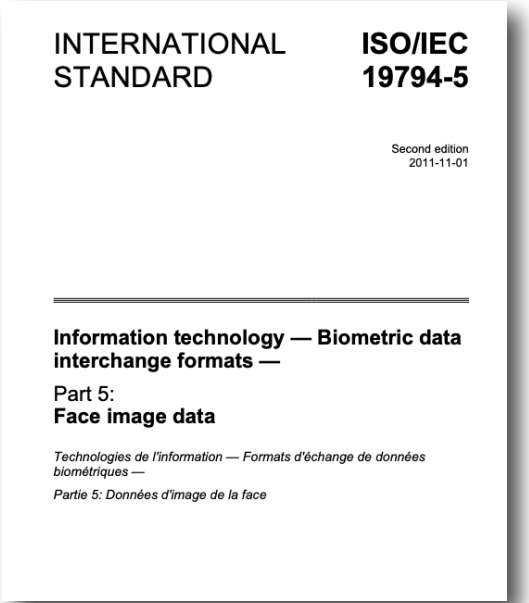
https://www.iso.org/standard/81005.html

Quality Requirements for Facial Images

The requirement in EES implementing decision 2019/329

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

What does that mean?


INTERNATIONAL STANDARD

ISO/IEC 19794-5

Second edition
2011-11-01

Information technology — Biometric data interchange formats —

Part 5:
Face image data

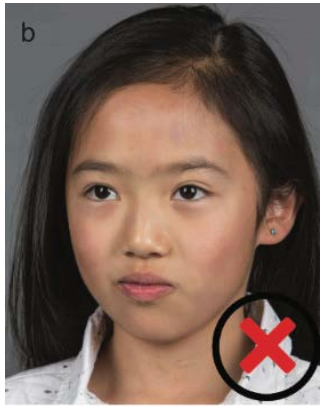
Technologies de l'information — Formats d'échange de données biométriques —

Partie 5: Données d'image de la face

Data subjects need actionable feedback

- If quality is poor, then what went wrong?

Compliant image



Pose

Eyes open

Mouth open

Inhomogenous background

Source: ISO/IEC 39794-5

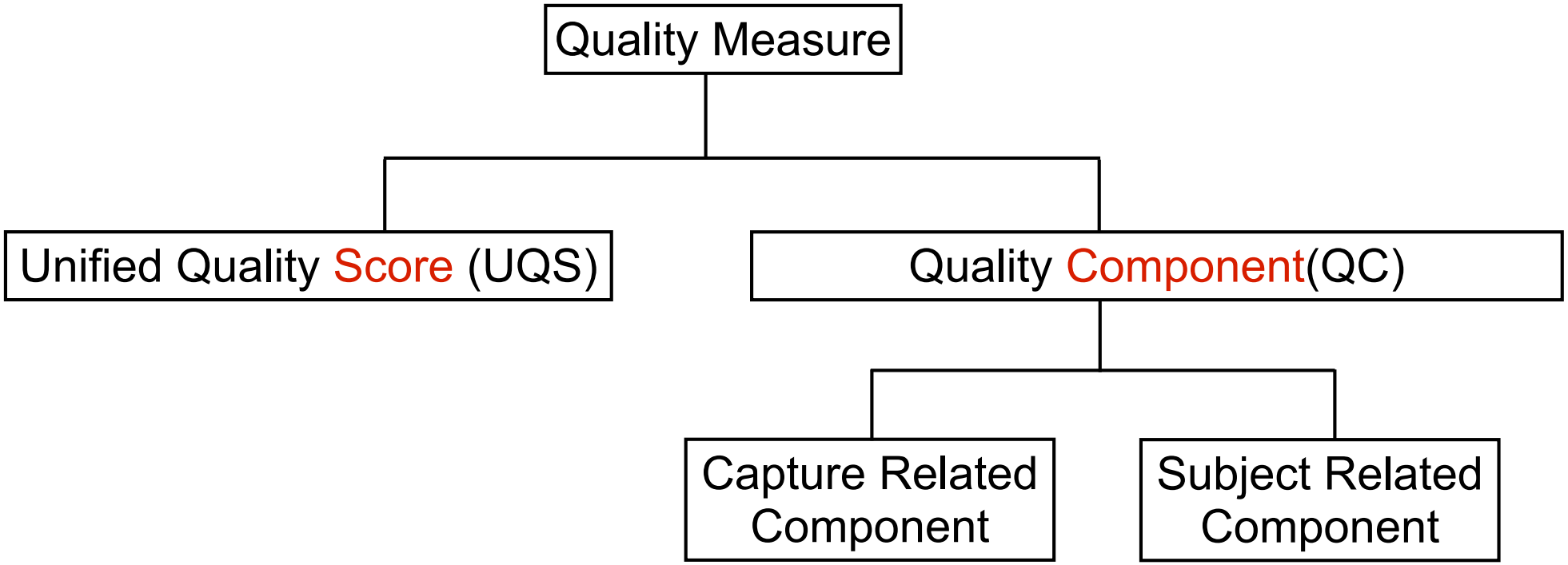
Quality Measures for Facial Images

Face image quality measures

- ISO/IEC 29794-5, Information technology - Biometric sample quality - Part 5: Face image data, https://www.iso.org/standard/81005.html
- Providing measures for requirements from ISO/IEC 19794-5:2011 and ISO/IEC 39794-5:2019
  - Use Case-1: Reference image for MRTD
  - Use Case-2: Reference image for Live-Enrolment at EES Kiosk
  - Use Case-3: Probe images (e.g. ABC gate)

ISO/IEC 29794-5: Face Image Quality

Quality assessment algorithms



- Higher UQS and QC imply higher biometric utility

ISO/IEC 29794-5: Face Image Quality

ISO/IEC 29794-5 quality measures in detail

#	Face image quality measure
1.	Quality score (unified)
2.	Background uniformity
3.	Illumination uniformity
4.	Luminance mean
5.	Luminance variance
6.	Under-exposure prevention
7.	Over-exposure prevention
8.	Dynamic range
9.	Sharpness
10.	No compression artefacts
11.	Natural colour
12.	Single face present
13.	Eyes open
14.	Mouth closed
15.	Eyes visible
16.	Mouth occlusion prevention
17.	Face occlusion prevention
18.	Inter-eye distance
19.	Head size
20.	Leftward crop of face in image
21.	Rightward crop of face in image
22.	Margin above face in image
23.	Margin below face in image
24.	Pose angle yaw frontal alignment
25.	Pose angle pitch frontal alignment
26.	Pose angle roll frontal alignment
27.	Expression neutrality
28.	No head covering

Image Source:ISO/IEC 29794-5

Unified Quality Score

Capture device related

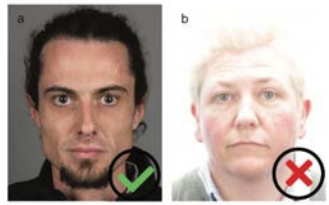


Image Source: ISO/IEC 39794-5

Explainable Quality Assessment

Subject related

Image Source: ISO/IEC 39794-5

Open Source Face Image Quality (OFIQ)

Reference implementation of ISO/IEC 29794-5

- Library with quality assessment algorithms
- Open source https://github.com/BSI-OFIQ/OFIQ-Project
  - Commercial use is enabled
- Support for major OS platforms (including mobile OS)
  - C/C++
- Selection criteria for integrated algorithms
  - Accuracy (NIST FATE SIDD evaluation)
    https://pages.nist.gov/frvt/reports/quality_sidd/frvt_quality_sidd_report.pdf
  - Low computational complexity
  - Liberal license (MIT or alike)
  - Limited demographic variability **NEW for OFIQ 2**

OFIQ - Unified Quality Score

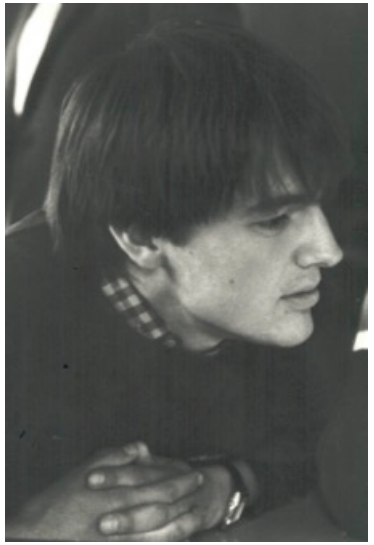
General, holistic unified quality score (OFIQ-UQS)

- Determine an overall quality score for the face image
  - CNN MagFace (iResNet 50 model)
- Shows good prediction of face recognition scores

OFIQ-UQS=84

OFIQ-UQS=61

OFIQ-UQS=26

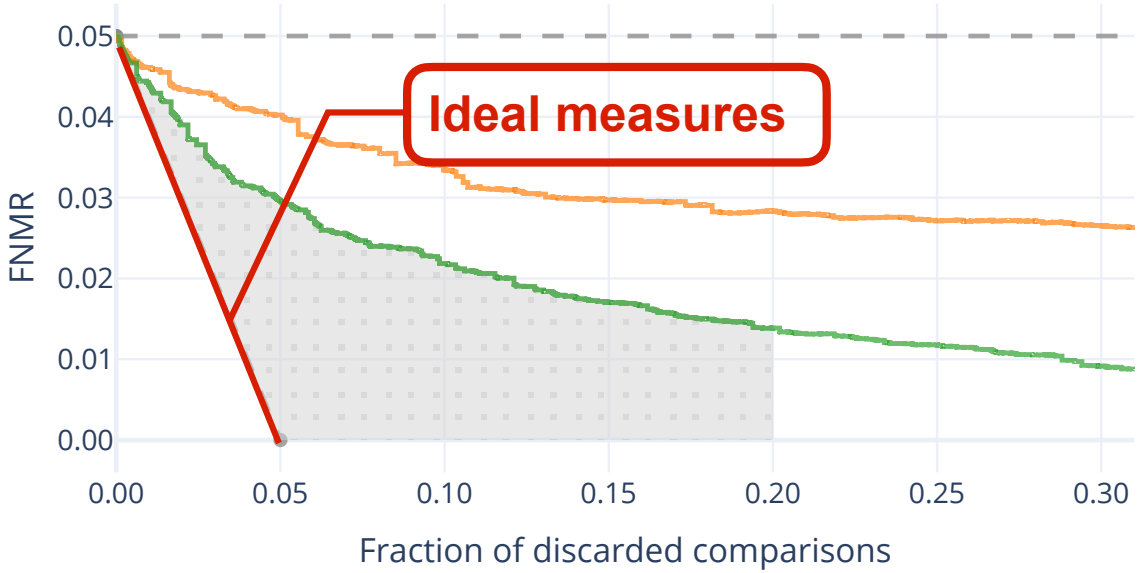


OFIQ-UQS=7

OFIQ - Unified Quality Score

Prediction of low face recognition scores

- OFIQ is the best performing algorithm in NIST SIDD Error versus Discard Characteristic (EDC) curves
  - How much is the FNMR reduced, when poor images are discarded/rejected?



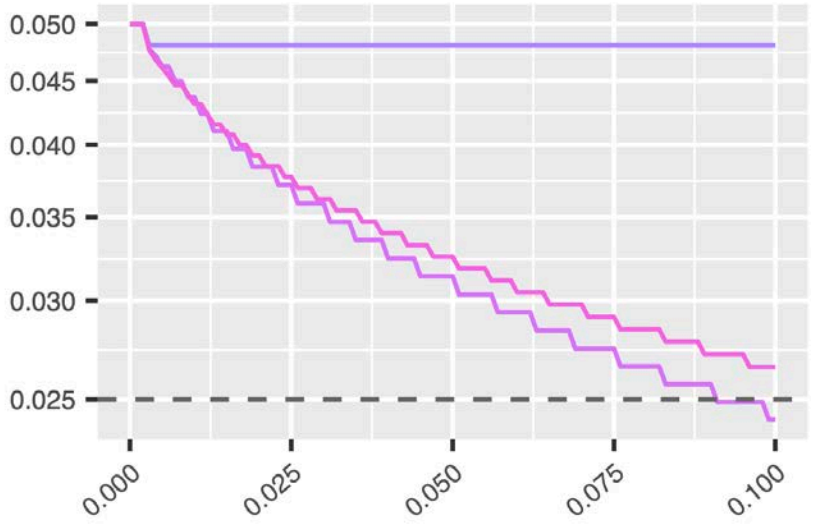


Image Source:NIST FATE SIDD report

[Schlett2023] T. Schlett, C. Rathgeb, J. Tapia, C. Busch: "Considerations on the Evaluation of Biometric Quality Assessment Algorithms", in IEEE Transactions on Biometrics, Behavior, and Identity Science (TBIOM), (2023)

OFIQ - Processing

Pre-processing for quality measures

- Face Detection: bounded box of all detected faces
- Face Landmark Estimation: localization of 98 key points
- Alignment: bring eyes on the same height
- Face Occlusion Segmentation: identify un-occluded region
- Face Parsing: identify different regions of subject in the image (eyes, eye brows, nose, lips, skin / neck, ears, hair / glasses, clothes, hats, earrings, necklaces / background)

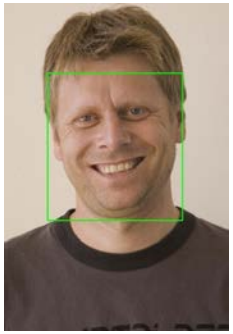
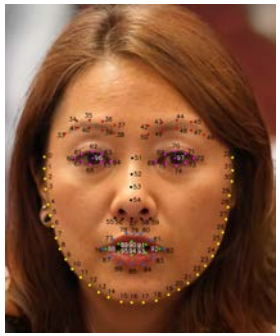




Image Source: OFIQ public report and ISO/IEC FDIS 29794-5

OFIQ - Quality Components

Example algorithm: Mouth Closed

- Detecting if the most is closed
- Algorithms based on landmarks
- Maximum distance between lips

$$D_L = \max\left(\|L_{89} - L_{95}\|_2, \|L_{90} - L_{94}\|_2, \|L_{91} - L_{93}\|_2\right)$$

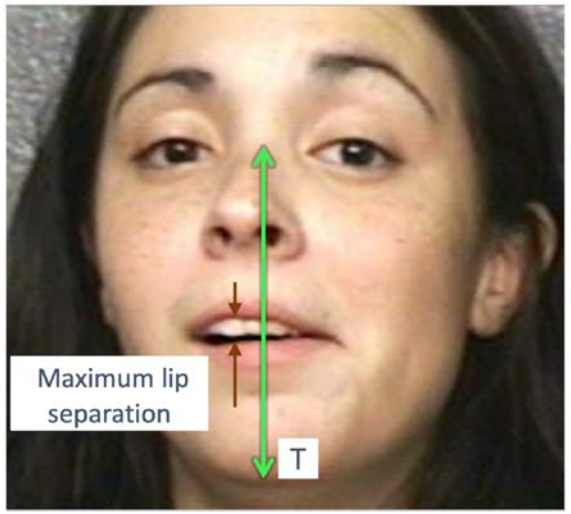
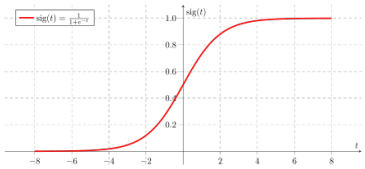


Image Source:NIST FATE SIDD report

- Normalized by distance T between eye‘s midpoint and chin
- Mouth opens aspect

$$\omega = \frac{D_L}{T}$$



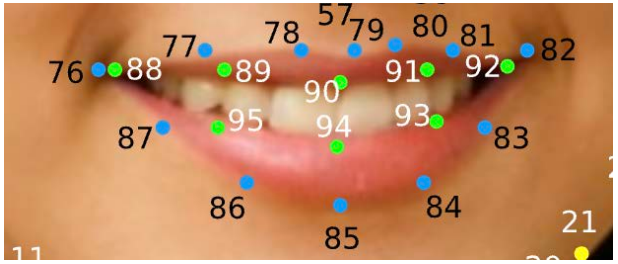


Image Source:ISO/IEC 29794-5

$$Q = \mathrm{ROUND}(100(1 - \mathrm{SIGMOID}(\omega, 0.2, 0.06)))$$

Status for OFIQ

Perspective

- OFIQ will (likely) replace the proprietary FIQA
  - wherever used
  - avoid a vendor-lock-in
- OFIQ 2.0 project is ongoing

Take home information on face image quality

- OFIQ open source code:
  https://github.com/BSI-OFIQ/OFIQ-Project
- OFIQ public report
  https://github.com/BSI-OFIQ/OFIQ-Project/blob/main/doc/reports/Public_Report_V1.1_2024_09_30.pdf
- NIST test report:
  https://pages.nist.gov/frvt/reports/quality_sidd/frvt_quality_sidd_report.pdf
- Face image quality website:
  https://christoph-busch.de/projects-ofiq.html
- Next OFIQ user group meeting is on 2026-07-21:
  https://eab.org/events/program/401

Relevant Standards

Biometric sample quality - Iris image data

ISO Standards Sectors About ISO Insights & news Taking part Store

Read sample

← TC ← ISO/IEC JTC 1/SC 37

ISO/IEC 29794-6:2015

Information technology — Biometric sample quality

Part 6: Iris image data

Published (Edition 1, 2015)

This publication was last reviewed and confirmed in 2021. Therefore this version remains current.

https://www.iso.org/standard/54066.html

New Standardisation Activity

Biometric sample quality - Iris image data

- Start ISO/IEC JTC1 SC37 Preliminary Work Item to prepare the revision of ISO/IEC 29794-6:2015
- Develop an open source reference implementation of ISO/IEC 29794-6:202x

Questions and Answers?

Take home information:

- Fingerprint image quality website:
  https://www.christoph-busch.de/projects-nfiq2.html
- Face image quality website:
  https://christoph-busch.de/projects-ofiq.html
- Standards website:
  https://www.christoph-busch.de/standards-sc37wg3.html