# Standards are critical for Interoperability

#### **Christoph Busch**

#### da/sec @ Hochschule Darmstadt - ATHENE, Germany NBL @ Norwegian University of Science and Technology - Gjøvik, Norway

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

Australian Government's Face Biometric Centre of Expertise 2022-03-10









### **Overview Standardisation**

#### Structure of relevant standards

- Introduction
- BioAPI
- Interchange formats
- Sample quality
- Presentation attack detection

### **Biometric Standardisation**

#### How does standardisation work?



#### Standards

### **Biometric Standardisation**



### **ISO/IEC SC37 Biometrics**

#### Established by JTC 1 in June 2002 to ensure

• 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, 2022

### Working Group 3

Title: Biometric Data Interchange

• Convenor: Christoph Busch (Germany)

### Terms of Reference:

 To consider the standardisation of the content, meaning, and representation of biometric data formats which are specific to a particular biometric technology. To ensure a common look and feel for Biometric Data Structure standards, with notation and transfer formats that provide platform independence and separation of transfer syntax from content definition

"Getting equipment to understand each other"

### Levels of Development - Standards

#### **Progression levels**

- Working Draft (WD)
- Committee Draft (CD)
- Draft International Standard (DIS)
- Final Draft International Standard (FDIS)
- International Standard (IS)

Issues to consider:

- Need for mature technology
- Decisions are made on consensus
- Commenting periods
- Potentially multiple loops at one level
- Need to progress
- Five year revision cycle



### **Expressions in International Standards**

In order to make clear what the user must do, the following verbal forms are used in standards:

- Requirements shall, shall not
- Recommendations should, should not
- Permission may, need not
- Possibility and capability can, cannot

### **Biometric Application Programming Interface**

## **Application Programming Interface - API**

Biometric systems maintenance requires

- Flexibility (plug-in of components)
- Avoiding vendor lock-in,
  - rather allow transparency and exchangeability
- Supporting scalability and expandable platforms



## **Application Programming Interface - API**

### BioAPI (Biometric API)

- Supports biometric enrolment and recognition
- Defines interfaces between subsystems that enables software or capture devices from multiple vendors to be integrated
- Communication between (sub-) systems using the Biometric Interworking Protocol (BIP)
- Support for applications, which observe multiple biometric characteristics (for example fingerprint, iris, and face)

ISO/IEC 19784-1: BioAPI specification, 2018

- Framework architecture and interfaces
- High-level C programming language specifications
- Also standards for embedded BioAPI and object oriented BioAPI (Java, C#)

### **Registration Authority**

International Biometrics Identity Association (IBIA) continues to serve as the Registration Authority (RA) for

- Register of biometric capture device identifiers
- Register of biometric feature extraction algorithm identifiers
- Register of biometric comparison algorithm identifiers
- Register of biometric quality algorithm identifiers
- Register of compression algorithm identifiers
- Example for comparison algorithms: https://www.ibia.org/cbeff/iso/register-of-biometric-comparison-algorithm-identifiers

	nternational Biometrics+Ic Association	lentity Reg	gister of biome	tric comparisor	n algorithm identifiers
Organization Name	Organization Identifier Hex	Organization Identifier Decimal	Comparison Algorithm Identifier Hex	Comparison Algorithm Identifier Decimal	Description
Sagem Morpho, Inc.	0x001D	29	n/a	n/a	MorphoSoft SDK MX01 matcher
ld3 Semiconductors	0x003F	63	0x0301	769	id3 match-on-smartcard
InTech, Inc.	004E	78	0001	1	IriCAMM MF1000 - Auto capturing, monocular type in recognition device, S version.
InTech, Inc.	004E	78	000A	10	IriCAMM BA1000 - Auto capturing, Binocular type iris recognition device. S version.

Standards

2022

#### **Biometric Performance Testing and Reporting**

### **Reporting Biometric Performance**

### DET curve (detection error trade-off curve)

- plots error rates on both axes
  - false positives on the x-axis
  - false negatives on the y-axis)



### **Demographic Effects**

### Algorithm bias reported in the media

- Movie Coded Bias
- Press information

Nov 4, 2020, 08:10am EST | 621 views

#### Biometrics Aren't Inherently Biased — We're Training Them Wrong



Stephen Ritter Forbes Councils Member Forbes Technology Council







Editor's Note: This post originally appeared on the Lawfare blog.

he European Union's <u>proposed</u> artificial intelligence (AI) regulation, released on April 21, is a direct challenge to Silicon Valley's common view that law should leave emerging technology alone. The proposal sets out a nuanced regulatory structure that bans some uses of AI, heavily regulates high-risk uses and lightly regulates less risky AI systems.

#### Standards

'Fascinating and deeply disturbing'

YUVAL NOAH HARARI, GUARDIAN BOOKS OF THE YEAR

### **Demographic Fairness**

### What is fairness?

 Dictionary: *"the quality of treating people equally or in a way that is right or reasonable"*

### An inherently ethical and social concept

 Influenced by cultural, historical, legal, religious, personal, and other factors



Image Source: https://www.flaticon.com (2020)

- No single, universal notion or definition of fairness in practice
- However, everyone wants to be treated "fairly"
- Reaching out towards group fairness
  - Work-in-progress standard ISO/IEC 19795-10 – how to quantify demographic differentials? https://www.iso.org/standard/81223.html

Standards

### **Demographic Factors**

### Biased machines – fair human experts?

#### Cognitive biases

 Examples in the field of biometrics: The other race effect

### Advantages and disadvantages

 Consistency over time (end-of-the-workday-effect)



### Hybrid systems

 Not fully automated decision systems but assisting algorithms

### **Biometric Data Interchange Formats**

### First Generation Format Standards



The 19794-Family: Biometric data interchange formats

### G3 development



Generation 3:

- Common semantics amongst all part
- All parts contain ASN.1 module and XSD schema
- Common document structure
- XSD to ASN.1 conversion tool exists

### G3 development

#### Status in 2022

- Several parts are published
  - Part 1 (Framework)
  - Part 4 (Finger image data)
  - Part 5 (Face image data)
  - Part 6 (Iris image data)
  - Part 9 (Vascular image data)
  - Part 16 (Full body image data)
  - Part 17 (Gait image sequence)
- Parts under development
  - Part 2 (Finger minutiae) DIS
  - Part 4 (Finger image data) AMD1
    - Extension towards improved interoperability with ANSI/NIST-ITL

## ICAO 9303 Logical Data Structure

Data stored on the chip (LDS)

- DG1: Information printed
  on the data page
- DG2: Facial image of the holder (mandatory)
- DG3: Fingerprint image of left and right index finger
- DG4: Iris image (not in the EU)
- DG15: Active Authentication Public Key Info
- DG16: Persons to notify Document Security Object
  - Hash values of DGs



Source: ICAO 9303 Part 10, 2015

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### ICAO 9303 Logical Data Structure

#### ICAO 9303 8th edition

- Facial image: ISO/IEC 39794-5:2019 https://www.iso.org/standard/72155.html
- Fingerprint images: ISO/IEC 39794-4:2019 https://www.iso.org/standard/72156.html

Adopted by ICAO in 2020

- ICAO has adopted its 9303 specification in 2020 and refers now to ISO/IEC 39794 and its Parts 1, 4 and 5.
- Passport reader equipment must be able to handle ISO/IEC 39794 data by 2025-01-01 (5 years preparation period).
- Between 2025 and 2030, passport issuers can use the old version or the new version of standards (5 years transition period).

ICAO TR based on ISO/IEC 49794 describing the transition from

- Facial image: ISO/IEC 19794-5:2005
- Fingerprint images: ISO/IEC 19794-4:2005
- preparing ICAO 9303 9th edition

### **Biometric Sample Quality**

#### **Revision ongoing**

- ISO/IEC 29794 Part 1: Framework (2nd CD)
- ISO/IEC 29794 Part 4: Finger image data (2nd WD)
- ISO/IEC 29794 Part 5: Face image data (4th WD)

### No activity for

• ISO/IEC 29794 - Part 6: iris image data

### **Biometric Sample Quality - Framework**

### ISO/IEC CD2 29794 - Part 1: Framework

- Development so far
  - Higher quality scores mean higher quality
  - EDC Python script for benchmarking Quality Assessment Algorithms
  - Quality algorithm IDs now modality specific
  - New entries to be registered with IBIA
- Open issues
  - Requirements for the normalization function
  - Operational relevance of quality assessment algorithm (former clause 10.4 moved out of Clause 10)



### **Biometric Sample Quality - Finger Image**

#### ISO/IEC WD2 29794 - Part 4: Finger image data

#### • alias NFIQ2.2

- Reference implementation is updated in GITHUB see: https://github.com/usnistgov/NFIQ2
- NIST IR 8382: https://nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8382.pdf
- European 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 ..."

L 57/18	LIN_	Official Journal of the European Union	26.2.2011
		COMMISSION IMPLIMENTING DECISION (81): 2019/129	
		of 25 February 2019	
	laying down the spe for biom	cifications for the quality, resolution and use of fingerprints a setric verification and identification in the Entry/Exit System (E	nd facial image ES)
THE	UROPEAN COMMERCION		
Havi	ng regard to the Treaty o	on the Functioning of the European Union,	
Havis entable cross enfor No 7 there	ng regard to Regulation habing an Entry/Exit Sys ing the external border cornent purposes and '67/2008 and Regulation of	(BJ) 2017/2226 of the European Parliament and of the Council stem (EE) to register entry and crit data and rehead of entry data of n of the Member Stars and determining the conditions for accura- stemeding the Convention implementing. The Schengen Agreement m (BJ) No 1077/2011 (); and in particular points (a) and (b) of Art	of 30 November 2017 third-country nationals ss so the EES for law t and Regulation (EC) ticle 36 first paragraph
Whe	real		
(1)	Regulation (EL) 2017 time and place of en Member States and wi	(2226 established the Entry/Exit System (EES) as a system which reg year and exit of third-country nationals admitted for a short stay bich calculates the duration of their authorised stay.	isten electronically the to the territory of the
(2)	The EES aims to impe the management of m who does not fulfil o States. Additionally, th and of other serious o	row the management of external borders, to prevent irregolar immig signation flows. The EES should, in particular, contribute to the idem to no longer lidflis the conditions of the authorised rara on the to the EES should contribute to the prevention, detection and investigati- riminal offences.	pration and to facilitate ification of any person mixory of the Momber on of terrorist offences
(1)	As quality and reliabil to lay down the spe biometric verification the electronic Machin impacts years after re fingerprint quality reg	ity of biomentic data are key success factors for EES to reach its full p cifications for the quality, resolution and use of both fingerprints and detertization in the EES, isolohing when taken line or estru- te Readule Travel Document (MRTD), As the quality of registred particulon iso the proper functioning of the EES, environmental and gataxion should be closely monitored on the long run.	overtial. It is necessary a and facial image for tod electronically from Engerprints will have I operational factors of
(4)	This decision does not	t create any new standards; it is coherent with ICAO standards.	
(9)	Rased on those mean systems in the area of architecture of the EE system and to develop	sures, the European agency for the operational management of 1 of freedoes, security and justice should then be able to define the 5 5 including its Communication Infrastructure, as well as the technic y the EES.	large-scale information design of the physical al specifications of the
(6)	In this framework, it and facial image for b	is thus necessary to adopt specifications for the quality, resolution i iometric verification and identification in the Entry/Exit System (EES).	and use of fingerprints
(7)	This Decision is with the Council (*).	out prejudice to the application of Directive 2004/18/8C of the Europ	pean Parliament and of
00	In accordance with A European Union and 1 adoption of Regulatio Regulation (BU) 2017 Protocol, notified on Denmark is therefore	rticles 1 and 2 of Protocol No 22 on the position of Dennark, are on the Treaty on the Functioning of the European Union, Dennark on e103 2017/2226 and is not bound by it or unipert to its application 7/2226 builds upon the 5drengen aquit, Dennark, in accordance 30 May 2018 in doction to implement May Doction. 2017/22 bound under intermisencial law to implement this Decision.	neard to the Treaty on lid not take part in the n. However, given that with Article 4 of that 26 in its national law.
00484	L 337, 9.12.2017, p. 26, nective 2004/34/EC of the 1 mly members to move an pealing Directives 64/2211 (Vector coll. 158, 30.4.20	Baropan Parlament and of the Council of 21 April 2004 on the right of citits al reside lively within the territory of the Member States amonthing Regulation IEE, 647-97.	ens of the Union and their er (EEC) No 1412/68 and 64(EEC: 35(365)EEC and

### **Biometric Sample Quality - Face Image**

### ISO/IEC WD4 29794 - Part 5: Face image data

- 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?



**ISO Standard** 



Too close

Pose Angle

Source: http://webstore.ansi.org

Standards

Gaze

## ISO/IEC IS 29794-5: Face Image Quality

### ISO/IEC 29794-5 shall be aligned with both

- ISO/IEC 19794-5:2011
- ISO/IEC 39794-5:2019
- Definitions
  - 6.2 Unified quality score FaceQnet (JRC)
  - 6.3 Capture-related quality elements
  - 6.4. Subject-related quality elements



a) Compliant image b) Low contrast source: ISO/IEC 39794-5:2019, Annex D https://www.iso.org/standard/72156.html



images with +8 degrees (left) and -8 degrees (right) rotation in roll Image Source: ISO/IEC 19794-5:2011



## ISO/IEC IS 29794-5: Face Image Quality

### ISO/IEC WD4 29794-5 quality elements in detail

#	Image quality aspect			
1.	Unified quality score			
2.	Background uniformity			
3.	Illumination uniformity			
4.	Illumination mean			
5.	Illumination variance			
6.	Illumination skewness			
7.	Illumination kurtsosis			
8.	Under-exposure			
9.	Over-exposure			
10.	Dynamic range			
11.	De-focus			
12.	Image sharpness			
13.	Motion blur			
14.	Edge density			
15.	Compression ratio			
16.	Unnatural colour and colour balance			
17.	Camera lens focal length			
18.	Camera subject distance			
19.	Eyes visible			
20.	Mouth occlusion			
21.	Nose occlusion			
22.	Inter-eye distance			
23.	Horizontal position of the face			
24.	Vertical position of the face			
25.	Pose			
26.	Expression neutrality			
27.	Mouth closed			
28.	Eyes open			

### This is a draft table

#### Capture device related

#### Subject related

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## Biometric Sample Quality - Face Image

### ISO/IEC WD4 29794 - Part 5: Face image data

- Development so far
  - Face Image Quality workshop on Nov 16-18 was fruitful https://eab.org/events/program/261
  - Quality elements, factors, aspects
- Open issues
  - Lightness or luminance (referring to CIELAB)
  - Redundancy of de-focus, sharpness, blur, edge-density
  - Description of an approach of pose estimation
  - Definitions and implementations of face image quality aspects
  - NIST competition: https://pages.nist.gov/frvt/html/frvt\_quality.html
- Join the SC37 WG3 work! https://www.iso.org/members.html



Standards

### **Liveness Detection**

### ISO/IEC 30107 - Presentation Attack Detection

Attacks on Biometric Systems



Source: ISO/IEC 30107-1 inspired by N.K. Ratha, J.H. Connell, R.M. Bolle, "Enhancing security and privacy in biometrics-based authentication systems," IBM Systems Journal, Vol 40. NO 3, 2001.

#### Standards

### Definitions in ISO/IEC 30107 PAD - Part 1: Framework

#### • presentation attack

presentation to the biometric capture subsystem with the goal of interfering with the operation of the biometric system

## presentation attack detection (PAD)

automated determination of a presentation attack

## Definitions in ISO/IEC 2382-37: Vocabulary http://www.christoph-busch.de/standards.html

#### impostor

subversive biometric capture subject who attempts to being matched to someone else's biometric reference

#### identity concealer

subversive biometric capture subject who attempts to avoid being matched to their own biometric reference

#### ISO/IEC 30107-1 - Definitions

#### • presentation attack instrument (PAI) biometric characteristic or object used in a presentation attack

#### artefact

artificial object or representation presenting a copy of biometric characteristics or synthetic biometric patterns

### Types of presentation attacks



### ISO/IEC 30107 parts

- Part 1 Framework
  - status: revision ongoing (1st CD)
- Part 2 Data formats

status: IS - published in 2016

Part 3 - Testing and Reporting

status: revision ongoing (FDIS)

• Part 4 - Profile for Evaluation of Mobile Devices

status: revision ongoing (3rd WD)

### **Presentation Attack Detection - Testing**

#### ISO/IEC FDIS 30107 - Part 3: Testing and reporting

- Testing the PAD subsystem with false-negative and false-positive errors:
- Attack presentation classification error rate (APCER) proportion of attack presentations using the same PAI species incorrectly classified as bona fide presentations in a specific scenario
- Bona fide presentation classification error rate (BPCER) proportion of bona fide presentations incorrectly classified as attack presentations in a specific scenario

### **Presentation Attack Detection - Testing**

### ISO/IEC FDIS 30107 - Part 3: Testing and reporting

 DET curve analyzing operating points for various security measures and convenience measures



### ISO/IEC FDIS 30107 - Part 3: Testing and reporting

- Development so far
  - Vocabulary adjusted
  - DET
  - New metric:  $RIAPAR(\tau) = IAPAR(\tau) + FRR(\tau)$ Relative impostor attack presentation attack rate (RIAPAR)



Standards

### **Makeup Presentation Attacks**

### ISO/IEC 30107-3 now also refers to alterations

- Makeup for impersonation
- Detection difficult since bona fide users may also apply makeup



[RDB2020] C. Rathgeb, P. Drozdowski, C. Busch: "Detection of Makeup Presentation Attacks based on Deep Face Representations", in Proceedings of 25th International Conference on Pattern Recognition (ICPR), (2020)

**Christoph Busch** 

### **Biometric Information Protection**

## ISO/IEC 24745:2022

#### Architecture for renewable biometric references



 Revision completed https://www.iso.org/standard/75302.html

Standards

#### **European Association for Biometrics**

## 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.
- structure of membership fees is inclusive
  - Free membership for Bachelor, Master and PhD students!

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## European Association for Biometrics (EAB)

### More Information

- Our initiatives are designed to foster networking
  - annual conference: EAB-RPC https://eab.org/events/program/219
  - biometric training event https://eab.org/events/program/224
  - workshops on relevant topics (e.g. Presentation Attack Detection, Morphing Attack Detection, Sample Quality, Bias in Biometric Systems)

https://eab.org/events/

- online Seminar every second week https://eab.org/events/program/268
- recorded keynote talks https://eab.org/events/lectures.html
- monthly newsletter https://eab.org/news/newsletter.html
- annual academic graduation report https://eab.org/files/documents/2021-10-29\_EAB-academic\_graduation\_monitoring\_report-2020.pdf
- open source repository https://eab.org/information/software.html

Standards









ou may want to become a member in order to see that lecture. Please register by using our form.

2022

### **European Association for Biometrics**

### Membership

- Membership fee is low
  - Industry (< 1 Mio) 475,00 EUR</p>
  - Industry (< 10 Mio) 1.250,00 EUR</p>
  - Industry (> 10 Mio) 2.750,00 EUR
  - Government 1.250,00 EUR
  - Academia/Association/NGO 475,00 EUR
  - Individual 95,00 EUR
  - Students 0 EUR
- Membership benefits are high
- For details visit: https://eab.org/membership/types\_of\_membership.html



### **Recent Standardisation Activities**

#### Short notifications on Twitter

#### https://twitter.com/busch christoph



Christoph Busch @busch christoph · 11. Jan.

The ISO/IEC JTC1 SC37 WG3 meeting started today. We have progressed ISO/IEC 19794-14 Biometric data interchange format - Part 14: DNA data to FDIS. Also the standard ISO/IEC 29794-1 Biometric sample quality - Part 1: Framework was discussed, which will be posted as 2nd CD.





Christoph Busch @busch christoph · 13. Jan.

Thanks to Patrick Grother @NIST for disposition of comments vesterday in the SC37 WG3 meeting. We made good progress on the revision project ISO/IEC 29794-5. This part is seeking more contributions. If you want to get an impression, look at theses slides: eab.org/files/events/2...



Christoph Busch @busch christoph · 12. Jan Thanks to @gfiumara (@NIST) for presenting today in the SC37 WG3 meeting the status report of NFIQ2.2. The working group also discussed the revision project ISO/IEC 29794-4. The presentation can be found on the NIST-website: nist.gov/services-resou...





Christoph Busch @busch christoph · 17. Jan. Thanks to Olaf Henniger (@Fraunhofer IGD/@ATHENECenter) for taking over the editorship of the revision project ISO/IEC 30107-1 PAD Framework. The document will now be posted as Committee Draft (CD). You can view the previous edition of this standard at: standards.iso.org/ittf/PubliclyA...



#### **Christoph Busch**

Standards

Web

- WG3 convenor's website with latest new http://www.christoph-busch.de/standards-sc37wg3.html
- ISO/IEC JTC SC37 http://isotc.iso.org/livelink/livelink? func=Il&objId=2262372&objAction=browse&sort=name
- ISO: How to write standards http://www.iso.org/iso/how-to-write-standards.pdf
- Wikipedia

http://en.wikipedia.org/wiki/ISO/IEC\_JTC\_1/SC\_37

Published ISO Standards

http://www.iso.org/iso/iso\_catalogue/catalogue\_tc/ catalogue\_tc\_browse.htm?commid=313770&published=on

 Common Criteria Portal: http://www.commoncriteriaportal.org/

### Complementary reading

- ISO/IEC TR 24741, "Biometrics tutorial", 2018 https://www.iso.org/obp/ui/#iso:std:iso-iec:tr:24741:ed-2:v1:en
- ISO/IEC SC37 SD11, "General biometric system architecture", 2010 http://isotc.iso.org/livelink/livelink? func=II&objId=8755976&objAction=Open
- ISO/IEC 2382-37, "Harmonized biometric vocabulary, 2012 http://www.christoph-busch.de/standards.html
- ISO/IEC 24722, "Multimodal biometrics", 2015 https://www.iso.org/obp/ui/#iso:std:iso-iec:tr:24722:ed-2:v1:en
- ISO/IEC 19795-1, "Biometric performance testing and reporting", 2021 https://www.iso.org/obp/ui/#iso:std:iso-iec:19795:-1:ed-2:v1:en

#### Complementary reading - interchange formats

- ISO/IEC 19794-1, "Biometric data interchange formats -Part 1: Framework", 2011 https://www.iso.org/obp/ui/#iso:std:iso-iec:19794:-1:ed-2:v1:en
- ISO/IEC 19794-2, "Biometric data interchange formats -Part 2: Finger minutiae data", 2011 https://www.iso.org/obp/ui/#iso:std:iso-iec:19794:-2:ed-2:v1:en
- ISO/IEC 19794-4, "Biometric data interchange formats -Part 4: Finger image data", 2011 https://www.iso.org/obp/ui/#iso:std:iso-iec:19794:-4:ed-2:v1:en
- ISO/IEC 19794-5, "Biometric data interchange formats -Part 5: Face image data", 2011 https://www.iso.org/obp/ui/#iso:std:iso-iec:19794:-5:ed-2:v1:en
- ISO/IEC 19794-6, "Biometric data interchange formats -Part 6: Iris image data", 2011 https://www.iso.org/obp/ui/#iso:std:iso-iec:19794:-6:ed-2:v1:en

#### Complementary reading - interchange formats G3

- ISO/IEC 39794-1, "Extensible biometric data interchange formats -Part 1: Framework", 2019 https://www.iso.org/obp/ui/#iso:std:iso-iec:39794:-1:ed-1:v1:en
- ISO/IEC 39794-4, "Biometric data interchange formats -Part 4: Finger image data", 2019 https://www.iso.org/obp/ui/#iso:std:iso-iec:39794:-4:ed-1:v1:en
- ISO/IEC 39794-5, "Biometric data interchange formats -Part 5: Face image data", 2019 https://www.iso.org/obp/ui/#iso:std:iso-iec:39794:-5:ed-1:v1:en

 ISO/IEC 39794-6, "Biometric data interchange formats -Part 6: Iris image data", 2021 https://www.iso.org/obp/ui/#iso:std:iso-iec:39794:-6:ed-1:v1:en

#### Complementary reading - quality

- ISO/IEC 29794-1, "Biometric sample quality -Part 1: Framework", 2016 https://www.iso.org/obp/ui/#iso:std:iso-iec:29794:-1:ed-2:v2:en
- ISO/IEC 29794-4, "Biometric sample quality -Part 4: Finger image data", 2017 https://www.iso.org/obp/ui/#iso:std:iso-iec:29794:-4:ed-1:v1:en
- ISO/IEC TR 29794-5, "Biometric sample quality -Part 5: Face image data", 2010 https://www.iso.org/obp/ui/#iso:std:iso-iec:tr:29794:-5:ed-1:v1:en
- ISO/IEC IS WD4 29794-5, "Biometric sample quality -Part 5: Face image data", 202x https://www.iso.org/standard/81005.htm
- ISO/IEC 29794-6, "Biometric sample quality -Part 6: Iris image data", 2011 https://www.iso.org/obp/ui/#iso:std:iso-iec:29794:-6:ed-1:v1:en

### Complementary reading - protection, PAD and mobile

- ISO/IEC 24745, "Biometric Information Protection", 2011 http://www.iso.org/iso/home/store/catalogue\_tc/catalogue\_detail.htm?csnumber=52946
- ISO/IEC 30107-1, "Biometric presentation attack detection -Part 1: Framework", 2016 http://standards.iso.org/ittf/PubliclyAvailableStandards/c053227\_ISO\_IEC\_30107-1\_2016.zip
- ISO/IEC 30107-3, "Biometric presentation attack detection -Part 3: Testing and reporting", 2017 http://www.iso.org/iso/home/store/catalogue\_tc/catalogue\_detail.htm?csnumber=67381
- ISO/IEC TR 30125, "Biometrics used with mobile devices", 2016 https://www.iso.org/obp/ui/#iso:std:iso-iec:tr:30125:ed-1:v1:en
- ISO/IEC 15408: "Security Techniques -Evaluation Criteria for IT Security / Common Criteria"

### References - for the SC37 member

### Bitbucket structure of repositories

https://sd.iso.org/bitbucket-pilot/projects/ISOIECJTC1SC37

https://sd.iso.org/.../ISOIECJTC1SC37/WG1 https://sd.iso.org/.../ISOIECJTC1SC37/WG2 https://sd.iso.org/.../ISOIECJTC1SC37/WG3

https://sd.iso.org/.../ISOIECJTC1SC37/WG6

≡	Bitbucket Projekte Repositorys ~
0	Repositorys
+	Q Repositorys nach Namen filtern
	Name this-is-the-test-repository
Ø	⊕ WG2
0	0 WG3
	Ø WG5

https://sd.iso.org/.../ISOIECJTC1SC37/WG3/29794 https://sd.iso.org/bitbucket-pilot/projects/ISOIECJTC1SC37/repos/wg3/browse/29794/part-01 https://sd.iso.org/.../ISOIECJTC1SC37/WG3/39794 https://sd.iso.org/.../WG3/39794/harmonization-assurance-test-tool https://sd.iso.org/.../WG3/39794/conversion-tools https://sd.iso.org/.../WG3/39794/conversion-tools/xsd-to-asn1-xslt https://sd.iso.org/.../WG3/39794/conversion-tools/asn1-to-xsd

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### Contact



#### Standards