International Standard

ISO/IEC 29794-5

First edition
2025-04

Information technology — Biometric sample quality —

Part 5: Face image data

Technologies de l'information — Qualité d'échantillon biométrique —

Partie 5: Données d'image de face

Reference number
ISO/IEC 29794-5:2025(en)

© ISO/IEC 2025



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
4 Abbreviated terms **4**
5 Conformance **4**
6 Common computations **6**
6.1 Overview 6
6.2 Conversion of 16 bits per channel images to 8 bits per channel images 7
6.3 Conversion of high bit-depth images to 8 bit greyscale or 24 bit colour images 7
6.4 Face detection 7
6.5 Face landmark estimation 8
6.6 Landmarked region segmentation 10
6.7 Face alignment 11
6.8 Face parsing 12
6.9 Face occlusion segmentation 13
6.10 Computing eye centres and inter-eye distance 14
6.11 Head pose estimation 15
6.12 Conversion of 8-bits-per-channel colour images to luminance 16
6.13 Conversion of 8-bits-per-channel colour images to CIELAB space 17
6.14 Handling of greyscale images 18
6.15 Luminance histogram 18
6.16 Entropy 18
6.17 Expressing binary quantities as continuous values 18
6.18 Representation and arithmetic of real and integer numbers 18
6.19 Normalization of image colour values 19
7 Quality measures **19**
7.1 General 19
7.2 Quality score (unified) 20
7.2.1 Description 20
7.2.2 Computation of the native quality measure 20
7.2.3 Mapping the computation result to the target range of the quality component 21
7.3 Capture-related quality components 21
7.3.1 General 21
7.3.2 Background uniformity 21
7.3.3 Illumination uniformity 22
7.3.4 Moments of the luminance distribution 23
7.3.5 Under-exposure prevention 25
7.3.6 Over-exposure prevention 25
7.3.7 Dynamic range 26
7.3.8 Sharpness 27
7.3.9 No compression artefacts 28
7.3.10 Natural colour 29
7.4 Subject-related quality components 30
7.4.1 General 30
7.4.2 Single face present 30
7.4.3 Eyes open 31
7.4.4 Mouth closed 32
7.4.5 Eyes visible 32
7.4.6 Mouth occlusion prevention 33
7.4.7 Face occlusion prevention 34

© ISO/IEC 2025 – All rights reserved

7.4.8 Inter-eye distance 34
7.4.9 Head size 35
7.4.10 Crop of the face image 36
7.4.11 Head pose 38
7.4.12 Expression neutrality 39
7.4.13 No head covering 40

8 Face image quality block 41
8.1 Binary encoding 41
8.2 XML encoding 41
8.3 Organization identifiers 41
8.4 Algorithm identifiers 41

Annex A (normative) **Conformance test assertions 44**

Annex B (informative) **Quantitative goal for face image QAAs 50**

Annex C (informative) **Applications of quality measures 53**

Annex D (informative) **Quality requirements with no quality measure 56**

Annex E (informative) **OFIQ testing reports 58**

Annex F (informative) **Guidance for sequential use of ISO/IEC 29794-5 quality components 59**

Bibliography 60

© ISO/IEC 2025 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and https://patents.iec.ch. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

This first edition cancels and replaces the first edition of ISO/IEC TR 29794-5:2010 which has been technically revised.

The main changes are as follows:

— the document has been completely revised to become and International Standard;

— information on the role of quality measures has been added;

— requirements on quality software have been added.

A list of all parts in the ISO/IEC 29794 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

© ISO/IEC 2025 – All rights reserved

Introduction

Adoption of deep learning techniques has caused error rates associated with automated face recognition tasks to be reduced. However, errors still occur and are often related to imaging, human factors, the level of biometric capture subject cooperation, the comparison algorithm, and its associated threshold and decision logic. Without significant modernisation of capture procedures, recognition errors will become more prevalent as volumes increase. This document is aimed at reducing errors due to image quality, through the use of quality assessment algorithms. Quality assessment algorithms have several roles (see Annex C), primarily those related to sample capture. Drivers for improved capture are as follows.

— Need for improved usability — The general improvement of biometric systems has highlighted that improved usability for both biometric capture subjects and human operators can reduce errors through the improvement of capture. Without a careful consideration of both biometric capture subjects and system operators, system designers risk seeing the limitations inherent in using technology alone.

— Increasing volumes — Vast numbers of face images are being collected in many commercial, civil identity management and law enforcement applications. These photographs are used as reference enrolment samples, or as recognition probes that, in turn, sometimes later serve as references.

— New programs — Future large-scale programs will employ face recognition: For example, in China the railway transportation system uses face recognition for identity verification and to improve passenger check-in efficiency. The European Union uses face recognition for biometric exit confirmation. The United States currently uses face recognition for biometric exit confirmation and vessel boarding. In India, the Aadhaar program allows face recognition for authentication.

— Face-blind cameras — Historically, many face images were collected using cameras that were not face-aware. In contrast, in some situations concerning fingerprint and iris biometrics, capture devices run in an auto-capture quality-assessment loop, with explicit awareness of the kind of image intended for collection.

— Reliance on imaging design specifications — Faces collected for ID credentials and authoritative databases are largely collected using cameras set up according to published documentary standards, most recently ISO/IEC 39794-5, regulating geometry and photography. In the best case, face images from such collections are then checked with image compliance tools. When photographs are collected by a human photographer, this can be without any automated quality assessment, relying only on the photographer to check conformance.

— Behaviour not intended by the relevant capture standard — Some recognition failures arise from biometric capture subjects effecting differences in presentation in reference and probe images. Standards define a canonical presentation to be centred and frontal with neutral expression, eyes-open and without occlusions. Facial recognition systems are expected to operate accurately across a wide range of individuals who vary in age, body size, ethnicity, language, culture, literacy and familiarity with technology. Careful human factors design is vital to the acquisition of canonical images and improved face image capture.

— Quality assessment is separated from the capture process — In many cases, a photograph is captured and later submitted to a backend server while ensuring no image tampering occurs, where it is assessed for quality. If poor quality is detected (by human or automated means), re-capture is initiated hours or days later, when possible, with another encounter and attendant expense.

Regarding image quality, Table 1 lists characteristics of face image quality relating to the biometric capture subject and characteristics relating to the capture process, demonstrating that issues due to mis-presentation (often associated with human factors design) and issues related to imaging are in many cases separable. For example, photographs can be systematically de-focused even when the biometric capture subjects present perfectly.

© ISO/IEC 2025 – All rights reserved

Table 1 — Characterization of face image quality

	Biometric capture subject characteristics	**Capture process**
Static properties	Biological characteristics; — injuries and scars, — dermatological conditions, — etc.	Capture process and capture device properties: — image resolution, — optical distortions, — sub-optimal camera angle, — field of view, — etc.
	Other static characteristics: — thick or dark glasses, — permanent jewellery, — makeup and cosmetics, — etc.	Static properties of the background: — (textured) wallpaper.
		Affordance: — properties of a data capture subsystem that intuitively imply its functionality and use to biometric capture subjects, — human-centric system physical and process design.
Dynamic properties	Behaviour: — exaggerated expression, — hair across the eye, — facial hair, — etc.	Scenery: — background moving objects, — variation in lightning.
		Capture device variation: — de-focus, — camera vibration, — sub-optimal camera angle, — poor exposure, — etc.

By defining image quality measurements, this document is intended to improve the accuracy of automated face recognition systems. Quality can be tied to recognition accuracy (see Annex B). Improved quality can also improve human review of images. The quality measures included in this document were selected because guidance on how to control them has already been included in ISO/IEC 39794-5. The implementations of some quality measures were evaluated for performance.[62] The reference implementation defines quality measures that use external algorithms with licence conditions.[58]

This document recognizes the Open Face Image Quality (OFIQ)[60] software as the reference implementation of the requirements of the document. It is open-source.[59] Other quality algorithm implementations can conform to this document as described in Clause 5.

Some of the computations of this document can be effective on images captured with illumination at non-visible wavelengths.

Encoding of quality data is defined in ISO/IEC 29794-1. The methodology for performance evaluation of quality assessment algorithms is also defined in ISO/IEC 29794-1.

NOTE Use of this document can be subject to local regulations.

© ISO/IEC 2025 – All rights reserved

Information technology — Biometric sample quality —

Part 5:
Face image data

1 Scope

This document establishes requirements on implementations that quantify how a face image's properties conform with those of canonical face images, for example those specified in ISO/IEC 39794-5:2019, Clause D.1, for three use-cases:

1) collection of reference samples for ID documents;

2) sample system enrolment; and

3) probes for instantaneous response.

This document also establishes terms and definitions for quantifying face image quality and specifies methods for quantifying the quality of face images.

This document does not establish requirements on:

— assessing the quality of pairs or sequences of images;

NOTE This document establishes requirements for software that inspects exactly one image. This document does not establish requirements for software that compares two or more images (such as biometric recognition). However, the computations of this document can be applied separately to each image in a pair or sequence.

— assessing the quality of 3D captures;

— encodings of face image quality data;

— performance evaluation of face image quality assessment algorithms.

The use cases within scope of this document primarily address the assessment of images from data capture subjects who consent to processing of their biometric data, or for whom biometric capture is operationally authorized.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 29794-1, *Information technology — Biometric sample quality — Part 1: Framework*

ISO/IEC 39794-1:2019, *Information technology — Extensible biometric data interchange formats — Part 1: Framework*

ISO/IEC 39794-5:2019, *Information technology — Extensible biometric data interchange formats — Part 5: Face image data*

ISO/IEC 19794-1:2011, *Information technology — Biometric data interchange formats — Part 1: Framework*

ISO/IEC 2382-37, *Information technology — Vocabulary — Part 37: Biometrics*

© ISO/IEC 2025 – All rights reserved

IEC 61966-2-1:1999, *Multimedia systems and equipment — Colour measurement and management — Part 2-1: Colour management — Default RGB colour space — sRGB*

IEC 61966-2-2:2003, *Multimedia systems and equipment — Colour measurement and management — Part 2-2: Colour management — Extended RGB colour space — scRGB*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 2382-37, ISO/IEC 29794-1, ISO/IEC 39794-5 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
canonical face image
face image conformant to an external standard or specification of a reference face image

Note 1 to entry: In many applications, the canonical face image is that given in ISO/IEC 39794-5:2019, Clause D.1, which specifies a reference face image for a machine-readable travel document.

Note 2 to entry: Most of the computations of this document can be effective on images captured in automated border control gates, visa images and other server-side images, which are in scope of this document.

3.2
de-focus
aberration in which an image or part of an image is out of focus

Note 1 to entry: De-focus tends to reduce the sharpness and contrast of the image.

3.3
face detection
process of determining whether and where faces are present in an image

3.4
face image
electronic image-based representation of the face of a capture subject

Note 1 to entry: Any image captured for use-cases 1 – 3 described in Clause 5 is considered as a face image.

Note 2 to entry: ISO/IEC 39794-5 includes a definition for face portrait as the visual representation of the capture subject, which includes the full-frontal part of the head, including hair in most cases, as well as neck and possibly top of shoulders. Face portraits appear in several places on and in a machine-readable travel document (MRTD).

Note 3 to entry: Given an image that has a roll angle of 90 ° or more (which is far from the presentation intended by ISO/IEC 39794-5:2019), a QAA can assign low quality component values or fail to return a record

[SOURCE: ISO/IEC 39794-5:2019, 3.27, modified — Notes to entry have been added.]

3.5
face bounding box
rectangle containing the central region of interest of a face visible in the face image

Note 1 to entry: The face bounding box is used for the estimation of landmarks to restrict the face image to the region of interest.

Note 2 to entry: The face bounding box is the result of the face detection process as defined in 6.4.

© ISO/IEC 2025 – All rights reserved