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Third edition
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Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 —

Part 5: Face image data

Technologies de l'information — Méthodologie d'essai de conformité pour les formats d'interéchange de données biométriques définis dans l'ISO/CEI 19794 —

Partie 5: Données d'image de la face

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Contents

Page

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

This third edition cancels and replaces the second edition (ISO/IEC 29109-5:2012), the tables of which have been technically revised.

ISO/IEC 29109 consists of the following parts, under the general title *Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794*:

— *Part 1: Generalized conformance testing methodology*

— *Part 2: Finger minutiae data*

— *Part 4: Finger image data*

— *Part 5: Face image data*

— *Part 6: Iris image data*

— *Part 7: Signature/sign time series data*

— *Part 8: Finger pattern skeletal data*

— *Part 9: Vascular image data*

— *Part 10: Hand geometry silhouette data*

Introduction

The ISO/IEC 19794-5:2005 standard specifies a data record interchange format for storing, recording, and transmitting one or more face images within a Common Biometric Exchange Formats Framework (CBEFF) data structure. Each image is accompanied by subject-specific and image-specific metadata contained in a header record. This part of the ISO/IEC 29109 multipart standard establishes tests for checking the correctness of the binary record.

The objective of ISO/IEC 19794-5:2005 cannot be completely achieved until biometric products can be tested to determine whether they conform to those specifications. Conforming implementations are a necessary prerequisite for achieving interoperability among implementations; therefore there is a need for a standardized conformance testing methodology, test assertions, and test procedures as applicable to specific modalities addressed by each part of ISO/IEC 19794. The test assertions will cover as much as practical of the ISO/IEC 19794 requirements (covering the most critical features), so that the conformity results produced by the test suites will reflect the real degree of conformity of the implementations to ISO/IEC 19794 Data Interchange Format records. This is the motivation for the development of this conformance testing methodology.

This part of ISO/IEC 29109 supports those applications that require use of face image data according to ISO/IEC 19794-5:2005. It defines a testing methodology to ensure conformance of a vendor's application or service to the base ISO/IEC 19794-5:2005 specification. Thus this document is intended to

— establish elements of the Conformance Testing Methodology framework that are specific to the Face Image-based Data Record requirements of ISO/IEC 19794-5:2005 conformance testing,

— define requirements and guidelines for specifying conformance test suites and related test methods for measuring conformity of products and services to the Face Image-based Data Record requirements of ISO/IEC 19794-5:2005, and

— define test procedures to be followed before, during, and after conformance testing.

This standard is applicable to the development and use of conformity test method specifications, conformity test suites for ISO/IEC 19794-5:2005 records, and conformance testing programs for ISO/IEC 19794-5:2005 conformant products. It is intended primarily for use by testing organizations, but may be applied by developers and users of test method specifications and test method implementations.

Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 —

Part 5: Face image data

1 Scope

This part of ISO/IEC 29109 specifies elements of conformance testing methodology, test assertions, and test procedures as applicable to two-dimensional face images defined in the ISO/IEC 19794-5:2005 biometric data interchange format standard for face image data.

This part of ISO/IEC 29109 establishes

— test assertions of the structure of the face image data format as specified in ISO/IEC 19794-5:2005 (Type A Level 1 as defined in ISO/IEC 29109-1:2009),

— test assertions of internal consistency by checking the types of values that may be contained within each field (Type A Level 2 as defined in ISO/IEC 29109-1:2009).

This part of ISO/IEC 29109 does not establish

— tests of conformance of 3D face records defined in ISO/IEC 19794-5:2005/Amd.2,

— tests of conformance of CBEFF structures required by ISO/IEC 19794-5:2005,

— tests of consistency with the input biometric data record (Level 3),

— tests of conformance of the image data to the quality-related specifications of ISO/IEC 19794-5:2005,

— tests of conformance of the image data blocks to the respective JPEG or JPEG 2000 standards,

— tests of other characteristics of biometric products or other types of testing of biometric products (e.g. acceptance, performance, robustness, security).

2 Conformance

Biometric data interchange format conformance tests conform to this part of ISO/IEC 29109 if they satisfy all of the normative requirements related to Clause 6. Specifically, they shall use the test methodology specified in Clauses 6, 7 and 8 of ISO/IEC 29109-1, and all Level 1 and Level 2 tests shall use the assertions defined in Table 2 of this part of ISO/IEC 29109.

Implementations of ISO/IEC 19794-5:2005 tested according to the methodology specified shall be able to claim conformance only to those biometric data record requirements specified in ISO/IEC 19794-5:2005 that are tested by the test methods established by this methodology.

Implementations of ISO/IEC 19794-5:2005 do not necessarily need to conform to all possible aspects of ISO/IEC 19794-5:2005, but only to those ISO/IEC 19794-5:2005 requirements that are claimed to be supported by the implementation in an Implementation Conformance Statement, filled out in accordance with Clause 8 of ISO/IEC 29109-1 and Table 1 of this part of ISO/IEC 29109.

3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 19794-5:2005, *Information technology — Biometric data interchange formats — Part 5: Face image data*

ISO/IEC 29109-1:2009, *Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 — Part 1: Generalized conformance testing methodology*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29109-1 apply.

5 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC 29109-1 apply.

6 Conformance testing methodology

6.1 Overview

The testing methodology specified in Clauses 6, 7 and 8 of ISO/IEC 29109-1 shall apply. The content of the tables below is based on the conformance testing methodology outlined in ISO/IEC 29109-1 and shall only be used in the context of that testing methodology.

6.2 Table of requirements in the base standard

The normative requirements of ISO/IEC 19794-5:2005 Biometric Data Interchange Format – Part 5: Face Image Data are listed in Table 1. The supplier of the IUT can explain which optional components of the standard are supported and the testing laboratory can note the results of the test.

Under subformat applicability the columns labelled B, F and T indicate the Basic, Full Frontal and Token Frontal image types.

Table 1 — Requirements of the Base Standard (ISO/IEC 19794-5:2005)

Requirement ID	Ref. in Base Std	Requirement Summary	Level	Status	Subformat Applicability			IUT Support	Supported Range	Test Result
					B	F	T			
R-1	5.2.1	Within the record format and all well-defined data blocks therein, all multi-byte quantities **are [implied shall]** stored in Big-Endian format. That is, the more significant bytes of any multi-byte quantity **are** stored at lower addresses in memory than less significant bytes. For example, the value 1025 (2 to the 10th power plus one) would be stored as first byte = 00000100 and second byte = 00000001.	1	M	Y	Y	Y			
R-2	5.2.2	Numeric Values All numeric values **are** fixed-length unsigned integer quantities, unless otherwise specified.	3C	O-3	Y	Y	Y			

Table 1 *(continued)*

Requirement ID	Ref. in Base Std	Requirement Summary	Level	Status	Subformat Applicability			IUT Support	Supported Range	Test Result
					B	F	T			
R-3	5.4.1	Format Identifier The (4 byte) Format Identifier **shall** consist of three ASCII characters "FAC" followed by a zero byte as a NULL string terminator to identify the record format as the face record format.	1	M	Y	Y	Y			
R-4	5.4.2	Version Number The (4 byte) Version Number block **shall** consist of three ASCII numerals followed by a zero byte as a NULL string terminator. The first and second character **will** represent the major version number and the third character **will** represent the minor revision number. The version number of this specification **shall** be 0x30313000; "010" – Version 1 revision 0..	1	M	Y	Y	Y			
R-5	Table 2	57 ≤ Length of Record ≤ 2^{32} - 1	1	M	Y	Y	Y			
R-6	5.4.3	Length of Record The (4 byte) Record Length Block **shall** be the combined length in bytes for the record. This is the entire length of the record including the Facial Record Header and Facial Record Data.	2	M	Y	Y	Y			
R-7	Table 2	1 ≤ Number of Facial Images ≤ 65 535	1	M	Y	Y	Y			
R-8	5.4.4	Number of Facial Images The (2 byte) Number of Facial Images block **shall** be the number of facial images included in the record.	2	M	Y	Y	Y			
R-9	5.5	The Facial Information block The (20 byte) Facial Information block is intended to describe discrete properties of the individual discernable from the image, one **is** included for each facial image included in the record. The structure of this block is shown in [ISO/IEC 19794-5:2005] Figure 2. Zero or more Facial Feature blocks, one Image Information block, and one Image Data block **follow** this block.	2	M-2	Y	Y	Y			
R-10	5.5.1	Facial Record Data Length The (4 byte) Facial Record Data Length field denotes the sum of the lengths of the Facial Information block, the Feature Point block(s), the Image Information block, and the Image Data block. The minimum value of the Facial Record Data Length **is** 32 bytes plus the size of the Image Data block (in bytes).	2	M	Y	Y	Y			
R-11	5.5.2	Number of Feature Points The (2 byte) Number of Feature Points block **shall** be the number of Feature Point blocks that follow the Facial Information block. The Feature Point block is defined in [ISO/IEC 19794-5:2005] Clause 5.6.	2	M	Y	Y	Y			
R-12	5.5.3	Gender The (1 byte) Gender block **shall** be specified in accordance with [ISO/IEC 19794-5:2005] Table 3.	1	M	Y	Y	Y			
R-13	5.5.4	Eye Colour The (1 byte) Eye Colour field **shall** represent the colour of irises of the eyes according to [ISO/IEC 19794-5:2005] Table 4. If the eyes are different colours, then right eye colour is to be encoded.	1	M	Y	Y	Y			

Table 1 *(continued)*

Requirement ID	Ref. in Base Std	Requirement Summary	Level	Status	Subformat Applicability			IUT Support	Supported Range	Test Result
					B	F	T			
R-14	5.5.5	Hair Colour The (1 byte) Hair Colour field **shall** represent the colour of the hair according to the [ISO/IEC 19794-5:2005] Table 5.	1	M	Y	Y	Y			
R-15	5.5.6	Property Mask The (3 byte) Property Mask is a bit mask of 3 bytes and each bit of the mask position listed in [ISO/IEC 19794-5:2005] Table 6 **shall** be set to 1 if the corresponding property is present, and set to 0 if absent. The mask position starts from 0 at the lowest bit. The lowest bit set to 0 shall indicate that properties are not specified (and all bits shall be zero); the lowest bit set to 1 **shall** indicate that all listed properties have been considered and that a zero value of any property bit indicates an absence of that property. Note that a Blink flag set to "1" **will** indicate non-compliance with the Frontal, Full Frontal, and Token image types.	2	M	Y	Y	Y			
R-16	5.5.7	Expression The (2 byte) Expression field **shall** represent the expression of the face according to [ISO/IEC 19794-5:2005] Table 7.	1	M	Y	Y	Y			
R-17	5.5.8	Pose Angle The (3 multi byte) Pose Angle field (B_Y, B_P, B_R) **shall** represent the estimate or measure pose of the subject in the image. Each byte in the field respectively represents pose angles of yaw, pitch and roll in that order. The pose angle is given by Tait-Bryan angles. • Yaw angle: Rotation about the vertical (y) axis. • Pitch angle: Rotation about the horizontal side-to-side (x) horizontal axis. • Roll angle: Rotation about the horizontal back to front (z) axis. The angles are defined relative to the frontal view of the subject, which has angles (0,0,0) as shown in [ISO/IEC 19794-5:2005] Figure 4. The examples are shown in [ISO/IEC 19794-5:2005] Figure 5. As order of the successive rotation around the different axes does matter, the encoded rotation angle **shall** correspond to an order of execution starting from the frontal view. This order **shall** be given by Roll (about the front axis), then Pitch (about the horizontal axis) and finally Yaw (about the vertical axis). The (first executed) Roll transformation will therefore always be in the image (x,y) plane. From the point of view of executing a transformation from the observed view to a frontal view, the transformation order **will therefore be** Yaw, Pitch, and then Roll. Note however that the encoded angle **is from** the frontal view to the observed view.	3C	O-1	Y	Y	Y			

Table 1 *(continued)*

Require-ment ID	Ref. in Base Std	Requirement Summary	Level	Sta-tus	Subformat Applicabil-ity			IUT Sup-port	Sup-ported Range	Test Result
					B	**F**	**T**			
R-18	5.5.8.1	Pose Angle – Yaw The yaw angle, Y, is the rotation in degrees about the y-axis (vertical axis) shown in [ISO/IEC 19794-5:2005] Figure 4. Frontal faces have a yaw angle of 0 degrees. Positive angles represent faces looking to their left (a counter-clockwise rotation around the y-axis). "The encoded value, BY, shall be stored in 1 byte with values 0 to 180 computed from a real-valued yaw angle estimate, −180 ≤ Y < 180, as follows": If 180 ≥ Y ≥ 0 and Y is even, then B_Y = Y/2+1 If 180 ≥ Y > 0 and Y is odd, then B_Y = (Y+1)/2 If −180 ≤ Y < 0 and Y is even, then B_Y = 181+Y/2. If −180 ≤ Y < 0 and Y is odd, then By = 181+(Y-1)/2 The maximum value of B_Y is 180. If the yaw angle is not specified, the value of B_Y **shall** be 0.	1	M	Y	Y	Y			
R-19	5.5.8.2	Pose Angle – Pitch The pitch angle, P, is the rotation in degrees about the x-axis (horizontal axis) shown in [ISO/IEC 19794-5:2005] Figure 4. Frontal faces have a pitch angle of 0 degrees. Positive angles represent faces looking down (a counterclockwise rotation around the x-axis). The encoded value, B_P, shall be stored in 1 byte with values 0 to 180 computed from a real-valued pitch angle estimate, - 180 ≤ *P* < 180, as follows If 180 ≥ *P* ≥ 0 and P is even, then B_P = P/2+1 If 180 ≥ *P* > 0 and P is odd, then B_P = (P+1)/2 If −180 ≤ *P* < 0 and P is even, then B_P = 181+P/2. If −180 ≤ *P* < 0 and P is odd, then B_P = 181+(P-1)/2 The maximum value of B_P is 180. If the pitch angle is not specified, the value of B_P **shall** be 0.	1	M	Y	Y	Y			
R-20	5.5.8.3	Pose Angle – Roll The roll angle, R, is the rotation in degrees about the z-axis (the horizontal axis from front to back) shown in [ISO/IEC 19794-5:2005] Figure 4. Frontal faces have a roll angle of 0 degrees. Positive angles represent faces tilted toward their right shoulder (counter-clockwise rotation around the z-axis). The encoded value, B_R, shall be stored in 1 byte with values 0 to 180 computed from a real-valued roll angle estimate, - 180 ≤ R < 180, as follows: If 180 ≥ R ≥ 0 and R is even, then B_R = R/2+1 If 180 ≥ R > 0 and R is odd, then B_R = (R+1)/2 If −180 ≤ R < 0 and R is even, then B_R = 181+R/2. If −180 ≤ R < 0 and R is odd, then B_R = 181+(R-1)/2 The maximum value of B_R is 180. If the roll angle is not specified, the value of B_R **shall** be 0.	1	M	Y	Y	Y			

Table 1 *(continued)*

Requirement ID	Ref. in Base Std	Requirement Summary	Level	Status	Subformat Applicability			IUT Support	Supported Range	Test Result
					B	F	T			
R-21	5.5.9	Pose Angle Uncertainty The (3 multi-byte) Pose Angle Uncertainty (U_Y, U_P, U_R) represents the expected degree of accuracy of the pose angle yaw, pitch, and roll. Each byte in the field respectively represents the uncertainty of yaw, pitch and roll in that order. The uncertainty is allowed to represent experimental uncertainty specified by each vendor. The encoding of Pose Angle Uncertainty is given by bytes (U_Y, U_P, U_R) where each byte U_K in the field (k = Y,P,R) represents 1 degree of uncertainty with minimum and maximum values of 1 and 181 where U_K = (uncertainty+1). The more uncertain, the value of the uncertainty U_K **shall** become larger. If the uncertainty is not specified, then the values of U_Y, U_P and U_R **shall** be set to zero (0).	1	M	Y	Y	Y			
R-22	5.6	The Feature Point Block The optional (8 byte) Feature Point block specifies the type, code and position of a Feature Point in the facial image. The number of Feature Point blocks **shall** be specified in the Number of Feature Points field of the Facial Information Block. The structure of this block is shown in [ISO/IEC 19794-5:2005] Table 8.	1	M	Y	Y	Y			
R-23	5.6.1	Feature Point Type The (1 byte) Feature Point Type field represents the type of the Feature Point stored in the Feature Point block. This field **shall** be set to 0x01 to denote that the position of the Feature Point is represented by the coordinate of the image. All other field values are reserved for future definition of Feature Point types.	1	M	Y	Y	Y			
R-24	5.6.2	Feature Point Code The (1 byte) Feature Point Code field **shall** specify the Feature Point that is stored in the Feature Point block. The codes of the Feature Points in [ISO/IEC 19794-5:2005] Clause 5.6.3, taken from the MPEG4 standard and defined as MPEG4 Feature Points, or the additional eye and nostril Feature Points in [ISO/IEC 19794-5:2005] Clause 5.6.4 **shall** be stored in this block. Each Feature Point code is represented by a notation A.B using a major (A) and a minor (B) value. The encoding of the Feature Point code **is given** by the (1 byte) value of A*16 + B.	1	M	Y	Y	Y			
R-25	5.6.3	MPEG4 Feature Points [ISO/IEC 19794-5:2005] Figure 6 denotes the Feature Point codes associated with Feature Points as given by Annex C of ISO/IEC 14496-2	3C	O-1	Y	Y	Y			
R-26	5.6.4	Eye and nostril centre Feature Points The eye centre Feature Points 12.1 (left) and 12.2 (right) **are defined** to be the horizontal and vertical midpoints of the eye corners (3.7, 3.11) and (3.8, 3.12) respectively. The left nostril centre Feature Point 12.3 **is defined** to be the midpoint of the nose Feature Points (9.1, 9.15) in the horizontal direction and (9.3,9.15) in the vertical direction. Similarly, the right nostril centre Feature Point 12.4 **is defined** to be the midpoint of the nose Feature Points (9.2, 9.15) in the horizontal direction and (9.3,9.15) in the vertical direction. Both the eye centre and nostril centre Feature Points are shown in [ISO/IEC 19794-5:2005] Figure 7 and values given in [ISO/IEC 19794-5:2005] Table 9.	3C	O-1	Y	Y	Y			