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

Part 9: Vascular 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 9: Données d'images vasculaires

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Foreword

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC 29109-9 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

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*

The following parts are under preparation:

— *Part 14: DNA data*

Finger pattern spectral data, signature/sign processed dynamic data and voice data will form the subjects of future parts.

Introduction

ISO/IEC 19794-9:2007 specifies a data record interchange format for exchange of human vascular image data among systems within a Common Biometric Exchange Formats Framework (CBEFF) data structure. The data stored in a vascular data record often contains the metadata storing the subject-specific and image-specific, as well as the technology being used. This part of ISO/IEC 29109 establishes tests for checking the correctness of the binary record.

When vascular image data is transmitted among systems, it can be interfered with by noise due to the transmission line. The received data might be incorrect during the exchange process. Therefore, there is a need to conduct conformance tests of commercial products to determine whether the data conform to ISO/IEC 19794-9:2007 before using the data for other purposes.

Vascular biometric technology is emerging or is under development by many research organizations. The vascular image resources are also being used by many vendors, who have utilized the vascular technology as a recognition or verification method in their systems. Currently, however, there is no standardized method for conducting conformance tests of vascular image data that supports ISO/IEC 19794-9:2007 during the exchange of vascular image data among systems. Application developers and implementers of different organizations can interpret ISO/IEC 19794-9:2007 in different manners. Therefore, a standardized conformance testing methodology is necessary for achieving interoperability among implementations.

This part of ISO/IEC 29109 supports those applications that require use of vascular image data according to ISO/IEC 19794-9:2007. It defines a testing methodology to ensure conformance of a vendor's application or service to ISO/IEC 19794-9:2007. Thus, it is intended to:

— establish elements of the conformance testing methodology framework that are specific to the vascular image-based data record requirements of ISO/IEC 19794-9:2007 conformance testing;

— define requirements and guidelines for specifying conformance test suites and related test methods for measuring conformity of products and services to the vascular image data record requirements of ISO/IEC 19794-9:2007; and

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

This part of ISO/IEC 29109 is applicable to the development and use of conformity test method specifications, conformity test suites for ISO/IEC 19794-9:2007 records, and conformance testing programs for ISO/IEC 19794-9:2007 conformant products. It is intended primarily for use by testing organizations, but can 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 9: Vascular image data

1 Scope

This part of ISO/IEC 29109 specifies elements of conformance testing methodology, test assertions, and test procedures as applicable to ISO/IEC 19794-9.

It specifies

— test assertions of the structure of the vascular image data format as specified in ISO/IEC 19794-9:2007 (Type A Level 1 as defined in ISO/IEC 29109-1),

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

It does not specify

— a test of conformance of CBEFF structures required by ISO/IEC 19794-9:2007,

— a test of consistency with an input biometric data record (Level 3),

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

— a test of conformance of systems that do not produce ISO/IEC 19794-9:2007 records.

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 29109-1:2009, and all Level 1 and Level 2 tests shall use the assertions defined in Table 2 in this part of ISO/IEC 29109.

Implementations of ISO/IEC 19794-9:2007 tested according to the specified methodology shall be able to claim conformance only to those Biometric Data Record (BDR) requirements specified in ISO/IEC 19794-9:2007 that are tested by the test methods established by this methodology.

Implementations of ISO/IEC 19794-9:2007 do not necessarily need to conform to all possible aspects of ISO/IEC 19794-9:2007, but only to those ISO/IEC 19794-9:2007 requirements that are claimed to be supported by the implementation in an Implementation Conformance Statement (ICS), filled out in accordance with Clause 8 of ISO/IEC 29109-1:2009 and Table 1 in this part of ISO/IEC 29109.

NOTE Level 3 and higher are not tested.

3 Normative references

The following referenced documents are indispensable for the application 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 19794-9:2007, *Information technology — Biometric data interchange formats — Part 9: Vascular 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 abbreviations given in ISO/IEC 29109-1 apply.

6 Conformance testing methodology

6.1 General

The testing methodology specified in Clauses 6, 7 and 8 of ISO/IEC 29109-1:2009 applies. 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 19794-9:2007 are listed in Table 1. The supplier of the implementation under test (IUT) can explain which optional components of ISO/IEC 19794-9:2007 are supported and the testing laboratory can note the results of the test.

Table 1 — Requirements of the base standard (ISO/IEC 19794-9:2007)

Requirement ID	Reference in Base Standard	Requirement Summary	Level	Status	IUT Support	Supported Range	Test Result
R-1	6.1	The quantities in all records and vascular biometric image elements (pixel data), if represented as multibyte quantities, are represented in big-endian format.	1	M		N/A	
R-2	6.1	The order for transmission shall also be the most significant byte first and the least significant byte last. Within a byte, the order of transmission shall be the most significant bit first and the least significant bit last.	3C	O-1		N/A	N/T
R-3	6.2	The scan sequence shall be raster scan order.	3C	O-1		N/A	N/T
R-4	7.1	The spatial resolution of the captured image shall be represented in terms of pixels per centimetre.	3C	O-1		N/A	N/T
R-5	7.2	The image shall have a dynamic range spanning at least 128 gray scale levels, allocating at least one byte (8 bits) per intensity value and providing at least 7 bits of useful intensity information.	1	M		N/A	
R-6	7.5	The captured image shall be an orthographic projection of the body area being imaged.	3C	O-1		N/A	N/T
R-7	7.6.2	If lossless compression is used the image data shall be compressed in accordance with the JPEG-LS lossless compression algorithm specified in ISO/IEC 14495 or the JPEG2000 compression algorithm specified in ISO/IEC 15444.	3C	O-1		N/A	N/T
R-8	7.6.3	If lossy compression is used the image shall be compressed in accordance with the JPEG compression algorithm specified in ISO/IEC 10918 or the JPEG2000 compression algorithm specified in ISO/IEC 15444.	3C	O-1		N/A	N/T
R-9	7.6.4	Images captured with more than three sensing channels shall be stored in accordance with the JPEG2000 compression algorithm as specified in ISO/IEC 15444.	3C	O-1		N/A	N/T
R-10	7.7	The location of human body used for imaging shall be specified in the format.	1	M		N/A	
R-11	7.7	The direction (left/right) of hand and/or finger index (thumb, index, middle, ring, and little) shall be specified.	1	M		N/A	
R-12	8.2.1	The format identifier for the vascular biometric image standard record shall consist of the three ASCII characters "VIR" followed by a null character (0x00).	1	M		N/A	
R-13	8.2.2	The number for the version of this standard used for constructing the image record shall be placed in four bytes. This version number shall consist of three ASCII numerals followed by a zero byte as a NULL string terminator. The first and second characters will represent the major version number, while the third character will represent the minor revision number. The current version number shall be 010 indicating the version 1 with no revision.	1	M		N/A	
R-14	8.2.3	The combined length in bytes for the entire record shall be recorded in these four bytes.	1	M			
R-15	8.2.3	This count shall be total length of record block including record header and image headers.	2	M			
R-16	8.2.4	The capture device ID shall be recorded in two bytes. A value of all zeros shall be acceptable and will indicate that the device ID is unreported. The vendor determines the value for this field. Application developers may obtain the values for these codes from the respective vendors.	1	M			

R-17	8.2.5	The number of vascular images included in the data block shall be recorded in two bytes.	2	M			
R-18	8.2.5	It is required that all images in a single vascular image data block be from the same imaging device. If two images are captured by two different devices with different capture device IDs, they shall be stored in separate data blocks, not in the same block.	3C	O-1		N/A	N/T
R-19	8.3.2	This four-byte field shall specify the total length of the image block including the image header and data.	1	M			
R-20	8.3.2	This four-byte field shall specify the total length of the image block including the image header and data.	2	M			
R-21	8.3.3	These two fields specify the horizontal and vertical image size in pixels, in two bytes for each field. If the image is compressed, these fields may contain the value IMAGE_WIDTH_UNDEF (0x0000).	1	M			
R-22	8.3.5	This field is a mandatory field specifying the position, direction, and properties of the object. The first two bits specify the direction of organ (toward the left or the right).	1	M		N/A	
R-23	8.3.6	The unit is degree normalized to 16-bit signed integer as (unsigned short) round (65536*(angle%360) /360).	1	O			
R-24	8.3.7	This two-byte field specifies whether the image is monochrome or color and how the image has been compressed if applicable.	1	M			
R-25	8.3.8	The type of illumination shall be categorized based on the wavelength of illumination source; that is, the wavelength of visible illumination is in the range of 400 nm through 750 nm, the wavelength of NIR is in the range of 750 nm through 5,000 nm, and the wavelength of MIR is in the range of 5,000 nm through 25,000 nm.	1	O		N/A	
R-26	8.3.9	If the background has been processed and set to monotone, then this field shall have the value IMAGE_BACKGROUND_MONO (0x01); otherwise this field shall have the value IMAGE_BACKGROUND_UNDEF (0x00).	1	M		N/A	
R-27	8.3.10	This field specifies the scan resolution in the horizontal direction in ppcm. If the horizontal scan resolution is not specified, this field shall contain the value H_SCAN_RES_UNDEF= 0 (0x0000).	1	M		N/A	
R-28	8.3.11	This field specifies the scan resolution in the vertical direction in ppcm. If the vertical scan resolution is not specified, this field shall contain the value V_SCAN_RES_UNDEF= 0 (0x0000).	1	M		N/A	
R-29	8.3.12	The first byte specifies y distance and the second byte x distance. For example, 0x0304 means an aspect ratio of 3:4. If this field is undefined (0x0000), the default aspect ratio is assumed which is 1:1.	1	M		N/A	

Status Notes:

1. Level 3 Assertion is too difficult to test

   No method has been defined to test the conformance of the IUT or BDIR for this mandatory requirement of the base standard. For the purposes of this part of ISO/IEC 29109, this requirement is marked as Optional until an appropriate test method is established.

6.3 Table of Level 1 and Level 2 Conformance Test Assertions

Table 2 — 19794-9:2007 Level 1 and Level 2 Conformance Test Assertions

Test Number	Section	Requirement ID	Level	Field Name	Operator	Operand	Test Note	Status	IUT Support	Supported Range	Test Result
1	Vascular image record header	R-12	1	Format Identifier	EQ	0x56495200		M		N/A	
1.1	Vascular image record header	R-1	1	Format Identifier	NEQ	0x00524956	1	M		N/A	
2	Vascular image record header	R-13	1	Format Version	EQ	0x30313000		M		N/A	
2.1	Vascular image record header	R-1	1	Format Version	NEQ	0x00303130	1	M		N/A	
3	Vascular image record header	R-14	1	Record Length	EQ	58 to 4294967295		M			
3.1	Vascular image record header	R-15	2	Record Length	EQ	Total Bytes Read	2	M		N/A	
3.2	Vascular image record header	R-15	2	Record Length	EQ	Total Bytes Expected	2	M		N/A	
4	Vascular image record header	R-16	1	Capture device ID	EQ	0 to 65535		M			
5	Vascular image record header	R-17	1	Number of images	EQ	0 to 65535		M			
5.1	Vascular image record header	R-17	2	Number of Images	C	Images Read		M		N/A	
6	Vascular image header	R-10	1	Image type identifier	MO	{0,1,2,3,4}		M		N/A	
7	Vascular image header	R-19	1	Record length	EQ	32 to 4294967295		M			
7.1	Vascular image header	R20	2	Record length	EQ	32+Image Bytes Read	3	M		N/A	
8	Vascular image header	R-21	1	Image width	EQ	0 to 65535		M			
9	Vascular image header	R-21	1	Image height	EQ	0 to 65535		M			
10	Vascular image header	R-5	1	Gray scale depth	EQ	0, 7 to 65535		M			

11	Vascular image header	R-11 R-22	1	Image position and property bit field	EQ	Bits 1 to 2 = 0 to 2 Bits 3 to 5 = 0 to 5 Bits 6 to 7 = 0 to 2 Bits 8 to 10 = 0 to 4		M		N/A	
12	Vascular image header	R-23	1	Rotation angle	EQ	0 to 65535		O			
13	Vascular image header	R-24	1	Image format and compression	EQ	0 to 9		M			
14	Vascular image header	R-25	1	Illumination type	MO	{0,1,2,3,4,5, 6,7,128,129, 130,131, 132,133, 134,135}		O		N/A	
15	Vascular image header	R-26	1	Image background definition	MO	{0,1}		M		N/A	
16	Vascular image header	R-27	1	Horizontal scan resolution	EQ	0 to 65535		M			
17	Vascular image header	R-28	1	Vertical scan resolution	EQ	0 to 65535		M			
18	Vascular image header	R-29	1	Pixel aspect ratio	EQ	0 to 65535		M			

Test Notes:

These are short notes that provide more detail about a specific conformance test assertion or requirement. They use a combination of explanatory text and pseudo code for complex calculations. The pseudo code uses commonly used mathematical notations, rather than the specific logical operators developed for the assertion language.

1. Test 1.1 and Test 2.1 check to see if these multi-byte quantities have been encoded as the Little-Endian equivalent of the correct Big-Endian value. These tests fail if that is true but pass in all other cases. The IUT is non conformant if it fails any of Tests 1, 1.1, 2 and 2.1 since these are all mandatory tests. Failing Test 1.1 will also mean that Test 1 will fail and similarly, failing Test 2.1 will also mean that Test 2 will fail. If all four of Tests 1, 1.1, 2 and 2.1 fail, then the IUT has probably used Little-Endian encoding.

2. The following calculation will be evaluated once the {Image record length} field for the last vascular image has been parsed successfully (not having reached an End-of-File marker prematurely). In the event that an End-of-File marker is reached prematurely this test will be marked as having failed, but no value of {Total Bytes Expected} will be produced.

   SUM=26

   FOR I=1 TO {Number of Images}

   SUM=SUM+32+{Record Length(defined in Vascular image header)}

   END

   {Total Bytes Expected}=SUM

   Where 26=size of {Vascular image record header} and 32=size of {Vascular image header}

3. The following calculation will be evaluated for each vascular image block.

   {Record length} = sizeof{Vascular image header} + sizeof image read

   Where 32=size of {Vascular image header}