INTERNATIONAL STANDARD

ISO/IEC 19795-4

First edition
2008-06-01

Information technology — Biometric performance testing and reporting —

Part 4: Interoperability performance testing

Technologies de l'information — Essais et rapports de performances biométriques —

Partie 4: Essais de performances d'interopérabilité

Reference number
ISO/IEC 19795-4:2008(E)

© ISO/IEC 2008

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2008

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

 © ISO/IEC 2008 – All rights reserved

Contents

Page

Foreword vi
Introduction vii
1 Scope 1
2 Conformance 1
3 Normative references 2
4 Terms and definitions 2
5 Abbreviated terms 4
6 Goals 5
6.1 Coverage 5
6.2 Target application 8
6.2.1 Biometric application 8
6.2.2 Interoperable application 9
6.3 Purpose 10
6.3.1 Interoperability testing 10
6.3.2 Sufficiency testing 11
7 Metrics 12
7.1 General 12
7.2 Figures of merit 12
7.2.1 Recognition performance figure of merit 12
7.2.2 Measuring component failure 13
7.3 Interoperability matrices 14
7.3.1 General 14
7.3.2 Interoperability with sBDB generators 14
7.3.3 Interoperability with sBDB generators 15
7.3.4 Fixed operating point interoperability 16
7.3.5 Reporting failure of sBDB generators 16
7.4 Proprietary performance 16
8 Conducting a test 17
8.1 Structure of test 17
8.2 Sample data 17
8.2.1 Acquisition 17
8.2.2 Representative data 18
8.2.3 Collection of ancillary data 18
8.2.4 Corpus size 18
8.2.5 Removal of subject-specific metadata 18
8.2.6 Removal of unrepresentative metadata 18
8.2.7 Origin of samples 19
8.2.8 Untainted samples 19
8.2.9 Sequestered data 19
8.3 Conformance testing 19
8.3.1 Conformance 19
8.3.2 Executing conformance tests 19
8.3.3 Reporting 20
8.4 Constraints on the sBDBs 20
8.4.1 Optional encodings 20
8.4.2 Optional encodings from profile standards 20
8.4.3 Deviation from the base standard 20
8.4.4 Data encapsulation 20

© ISO/IEC 2008 – All rights reserved

8.5 Components 21
8.5.1 Components for sufficiency testing 21
8.5.2 Establishing modularity requirements 21
8.5.3 Components for interoperability testing 21
8.5.4 Underlying algorithms 21
8.5.5 Capture device user interfaces 21
8.5.6 Multimodal components 22
8.5.7 Component variability 22
8.5.8 Component reporting requirements 22
8.6 Planning decisions 22
8.6.1 Computational intensity 22
8.6.2 Supplier recruitment 23
8.6.3 Provision of samples to suppliers 23
8.6.4 Equivalency of generator resources 23
8.6.5 Handling violations of test requirements 24
8.6.6 Comparison subsystem output data encapsulation 24
8.6.7 Fundamental generator requirement 24
8.6.8 Fundamental comparison subsystem requirement 25
8.6.9 General requirements on software implementations 25
8.7 Prevention and detection of gaming 26
8.7.1 General aspects 26
8.7.2 Modes of gaming 26
8.7.3 Prevention and detection of gaming 28
8.8 Test procedure 29
8.8.1 Primary test 29
8.8.2 Uncertainty measurement 30
8.8.3 Variance estimation 30
8.8.4 Remedial testing 30
8.8.5 Survey of configurable parameters 30

9 Interpretation of the interoperability matrix 30
9.1 Determination of interoperable subsystems 30
9.1.1 General 30
9.1.2 Identifying interoperable combinations of subsystems 31
9.1.3 Acceptable numbers of interoperable subsystems 33
9.1.4 Combinatorial search for maximum interoperability-classes 33
9.1.5 Multiple interoperable subgroups 34
9.1.6 Statistical stability of the test result 34
9.2 Interoperability with previously certified products 35
9.2.1 Decertification considerations 35
9.2.2 Continuity of testing 35
9.2.3 Interoperability with previously certified generators 35
9.2.4 Interoperability with previously certified comparison subsystems 36
9.2.5 Treatment of systematic effects 36
9.2.6 Retroactive exclusion from analysis 37
9.3 Overall sufficiency 37

Annex A (informative) **Procedures for conducting a test of sufficiency and/or interoperability** 38

Annex B (informative) **Example Interoperability Test** 42

Bibliography 45

Figure 1 — General biometric interoperability 6

Figure 2 — Specific interoperability: enrolment BDB is standardized 6

Figure 3 — Specific interoperability: enrolment BDB is proprietary 7

Figure 4 — Offline interoperability testing 7

Figure 5 — Biometric capture device interoperability 8

 © ISO/IEC 2008 – All rights reserved

Figure 6 — Cells of an example interoperability space **10**
Figure 7 — Sufficiency testing: proprietary vs. standard interchange formats **12**
Figure 8 — Cross-generator performance matrix **15**
Figure 9 — Example performance matrix **15**
Figure 10 — Proprietary performance matrix **16**

Table 1 – Conformity with ISO/IEC 19795-2 ..... **1**
Table 2 – Sample size adjustment of error rate requirement **31**
Table 3 – Confidence levels of the standard Normal distribution **32**
Table A.1 – Interoperability test procedure, phase 1: planning **38**
Table A.2 – Interoperability test procedure, phase 2: setup **39**
Table A.3 – Interoperability test procedure, phase 3: sBDB and pBDB generation **39**
Table A.4 – Interoperability test procedure, phase 4: verification **40**
Table A.5 – Interoperability test procedure, phase 5: identification **40**
Table A.6 – Interoperability test procedure, phase 6: reporting **41**
Table A.7 – Interoperability test procedure, phase 7: variance estimation **41**

© ISO/IEC 2008 – 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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

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.

ISO/IEC 19795-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

ISO/IEC 19795 consists of the following parts, under the general title *Information technology — Biometric performance testing and reporting*:

— *Part 1: Principles and framework*

— *Part 2: Testing methodologies for technology and scenario evaluation*

— *Part 3: Modality-specific testing* [Technical Report]

— *Part 4: Interoperability performance testing*

Part 6: Testing methodologies for operational evaluation is under preparation.

 © ISO/IEC 2008 – All rights reserved

Introduction

The multi-part biometric data interchange format standard, ISO/IEC 19794, has been developed to foster interoperable exchange of biometric data. By defining open containers for image, signal and feature data, and constraining some of the properties of the samples, the standards enhance interoperability by requiring implementers to be able to handle a restricted set of all possible biometric samples. Examples of this are the template standards of ISO/IEC 19794-2 and ISO/IEC 19794-8 which embed compact processed data from fingerprint images. Only samples of the same format type (several of which can be defined in the same part of ISO/IEC 19794) are intended to be interchangeable.

One common assertion prior to SC 37's formulation of data interchange standards was that proprietary templates offer greater recognition performance than any likely standard on the grounds that the proprietary instances are the product of processes that embed considerable, private, intellectual property. The question of whether the emerging standards are sufficient then arises: that is, do they code data (feature, image, etc.) representations that allow matching with accuracy comparable to that available from the proprietary solutions?

A second issue, interoperability, arises in those applications where standardized data are generated and matched by different institutions and systems. If a company's feature extraction subsystem processes acquired samples to produce ISO/IEC 19794-x compliant instances, then can other companies' comparison subsystems attain performance comparable with that obtained from the originator's own comparison subsystem? A further question is then whether a third company can successfully recognize enrolment and user samples from two different sources.

This part of ISO/IEC 19795 defines tests to specifically address absolute performance, sufficiency, and interoperability available from biometric data formatted to comply with established standards, particularly those developed in the various parts of ISO/IEC 19794. However, because this part of ISO/IEC 19795 references interchange formats generically, by referencing only their black box generation and use, it also applies to other open standards. One consequence of this approach is that the success of a test is predicated on the correctness and appropriateness of lower-level data elements and values, i.e. conformance to the respective standards. Therefore, the approach here is to require conformance testing as an integral part of the test. This is achieved by referencing formal published conformance tests or profiles of standards. For instance, an interoperability test of the ISO/IEC 19794-5 face format might reference an application profile of its Token image, which in turn might rely on ISO/IEC 15444-1 (JPEG 2000 core coding system).

This part of ISO/IEC 19795 conceives of the following three kinds of tests:

- **online:** a scenario test in which a volunteer population enrols on suppliers' products and subsequently uses suppliers' verification or identification implementations to make genuine and impostor attempts;
- **offline:** a technology test in which an archived corpus of captured samples, not necessarily collected with any intent to simulate the operational conditions of a particular application, is used as input to suppliers' enrolment, verification or identification products to make genuine and impostor attempts;
- **hybrid:** a test in which the sample corpus is collected online under conditions which attempt to simulate the operational conditions of a particular application, and is then processed offline.

In each case, an interoperability test needs to embed multi-supplier generation, exchange, and comparison of samples of the standard interchange format. Online collection from a live population is appropriate when the biometric capture device, and/or the subject interaction with the biometric capture device, is considered to have a material effect on the interoperable performance of the intended application. An offline test is appropriate when a representative corpus of samples is already available (for example passport photographs to be converted into Token instances of ISO/IEC 19794-5). An offline test may be appropriate when the collection of representative data is neither practical nor necessary to determine the interoperable performance of specific subsystems, such as feature extraction and/or comparison.

© ISO/IEC 2008 – All rights reserved

In all cases, an interoperability test must enrol subjects on one or more products and verify or identify on one or more others. This should involve subjects making transactions as themselves (genuine trials) and as one or more other people (impostor trials). If a large enough population is available, a disjoint impostor population can be used. Since online tests can become onerous on the test population when many products and impostor attempts are needed, hybrid and offline testing allow execution of many zero-effort impostor attempts.

In an interoperability performance test, J generators of standardized biometric data blocks (BDBs) are applied to the samples assembled as part of a hybrid or offline test. By applying K comparison subsystems to the standard BDBs, up to KJ^2 verification or identification trials are conducted, each following ISO/IEC 19795-2. The BDB may be an image or signal, or a standardized template. Optional encodings allowed by the standard interchange format should be fully specified. This might be achieved by normatively referencing one of the ISO/IEC 24713-x profiles. If the format in question is an image, a subsequent internal (usually proprietary) template would be used, but its existence here is subsumed by the notion of a black-box comparison of two instances of the given format.

The test advanced by this part of ISO/IEC 19795 demarcates the generic aspects of interoperability from the meaning associated with each particular biometric format of ISO/IEC 19794-x.

© ISO/IEC 2008 – All rights reserved

Information technology — Biometric performance testing and reporting —

Part 4: Interoperability performance testing

1 Scope

This part of ISO/IEC 19795 prescribes methods for technology and scenario evaluations of multi-supplier biometric systems that use biometric data conforming to biometric data interchange format standards.

It specifies requirements needed to assess

— performance available from samples formatted according to a standard interchange format (SIF),

— performance available when samples formatted according to a SIF are exchanged,

— performance available from samples formatted according to a SIF, relative to proprietary data formats,

— SIF interoperability, by quantifying cross-product performance relative to single-product performance,

— performance available from multi-sample and multimodal data formatted according to one or more SIFs, and

— performance interoperability of biometric capture devices.

In addition, this part of ISO/IEC 19795

— includes procedures for establishing an interoperable set of implementations,

— defines procedures for testing interoperability with previously established sets of implementations, and

— gives testing procedures for the measurement of interoperable performance.

It does not

— establish a conformance test for biometric data interchange formats, or

— provide test procedures for online data collection.

2 Conformance

An interoperability performance test conforms to this part of ISO/IEC 19795 if it satisfies the requirements specified in Clauses 6, 7, 8 and 9 of this part of ISO/IEC 19795 and the requirements specified in the clauses of ISO/IEC 19795-2 referenced in Table 1.

Table 1 — Conformity with ISO/IEC 19795-2

Structure of ISO/IEC 19795-4 test	ISO/IEC 19795-2 conformance
Online (8.2.1.3)	Clause 7 (Scenario evaluation)
Hybrid (8.2.1.4)	Clause 6 and Clause 7
Offline (8.2.1.2)	Clause 6 (Technology evaluation)

© ISO/IEC 2008 – All rights reserved

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 19795-1, *Information technology — Biometric performance testing and reporting — Part 1: Principles and framework*

ISO/IEC 19795-2, *Information technology — Biometric performance testing and reporting — Part 2: Testing methodologies for technology and scenario evaluation*

© ISO/IEC 2008 – All rights reserved