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Information technology — Biometric performance testing and reporting —

Part 6:
Testing methodologies for operational evaluation

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National foreword

This British Standard is the UK implementation of .

The UK participation in its preparation was entrusted to Technical Committee IST/44, Biometrics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Part 6: Testing methodologies for operational evaluation

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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 19795-6 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 5: Access control scenario and grading scheme*

— *Part 6: Testing methodologies for operational evaluation*

— *Part 7: Testing of on-card biometric comparison algorithms*

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Introduction

Operational tests evaluate complete biometric systems in the targeted operational environment with the target population. Tests may encompass performance monitoring of operational systems or assessment of performance in operational trials.

Operational performance assessment may be based on:

— data collected by the operational system in the course of normal operation;

— additional data collected during normal system use, but with the system running in an “evaluation mode” allowing extra data to be collected;

— data collected with a set of test subjects considered separately from the subject base of the operational system.

Operational evaluation differs from technology or scenario evaluation in that the subject base, environment, and system design are no longer controlled for the purpose of repeatable testing, but vary in accordance with operational use. Examples of uncontrolled variables include the legitimacy of the subject’s identity claim, environmental effects from weather or lighting, or the variability of system use by different individuals.

The overarching goals of operational testing are to measure or monitor operational biometric system performance over a period of time.

Subgoals of operational testing may include:

— to determine if performance meets the requirements specified for a particular application or the claims asserted by the supplier;

— to determine the need to adjust or configure the system to improve performance;

— to predict performance as the numbers of subjects, locations, or devices increase;

— to obtain information on the target population and environmental parameters found to affect system performance;

— to obtain performance data from a pilot implementation;

— to obtain performance data to benchmark future systems.

This part of ISO/IEC 19795 provides the test planning, test conduct, performance measurement, test reporting, and record keeping requirements to be followed during a biometric system’s operational evaluation.

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INTERNATIONAL STANDARD ISO/IEC 19795-6:2012(E)

Information technology — Biometric performance testing and reporting —

Part 6:
Testing methodologies for operational evaluation

1 Scope

This part of ISO/IEC 19795:

— provides guidance on the operational testing of biometric systems;

— specifies performance metrics for operational systems;

— details data that may be retained by operational systems to enable performance monitoring; and

— specifies requirements on test methods, recording of data, and reporting of results of operational evaluations.

NOTE Some operational biometric systems perform a single biometric function. For example, in the initial stages of rollout of biometric passports, the operational system might be performing biometric enrolment only. Operational evaluation of such systems is within the scope of this part of ISO/IEC 19795.

This part of ISO/IEC 19795 does not:

— cover testing of operational systems in the laboratory or

— address vulnerability testing.

2 Conformance

An operational evaluation is in conformance with this part of ISO/IEC 19795 if it is planned, executed and reported in accordance with the requirements of Clause 6.

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*

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4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19795-1 and the following apply.

4.1
acclimatization
change, over the course of one or more transactions, of a biometric characteristic that might impact the ability of a system to process a sample

NOTE Acclimatization is primarily associated with a subject's temporal adjustment to environmental effects, such as skin temperature.

4.2
attendant
agent of the biometric system operator who directly interacts with the biometric capture subject

4.3
biometric capture subject
individual who is the subject of a biometric capture process

4.4
biometric data subject
individual whose individualized biometric data is within the biometric system

4.5
biometric probe
biometric data input to an algorithm for comparison to a biometric reference(s)

4.6
biometric operational personnel
individuals, other than the biometric capture subjects, who take an active role in the operation of the biometric system

NOTE Biometric operational personnel includes biometric system administrators, attendants, and examiners.

4.7
biometric system administrator
person who executes policies and procedures in the administration of a biometric system

4.8
biometric system operator
organization responsible for defining policies and procedures in the operation of a biometric system

4.9
biometric reference
one or more stored biometric samples, biometric templates or biometric models attributed to a biometric data subject and used for comparison

4.10
comparison attempt limit
maximum allowed number or duration of attempts in a comparison transaction

4.11
enrolment attempt limit
maximum allowed number or duration of attempts in an enrolment transaction

4.12
habituation
familiarity a subject has with the biometric device, system and application

NOTE The level of habituation can affect biometric sample presentation and acquisition device.

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4.13
subject base
set of individuals whose biometric data is intended to be enrolled or compared in operational use of a biometric system

4.14
system acceptance rate
proportion of recognition transactions in an operational system in which the subject is recognized

NOTE 1 Though the acceptance of an impostor is an incorrect recognition, it can still count as a system acceptance.

NOTE 2 System acceptance rate = 1 – system rejection rate.

4.15
system identification rate
proportion of identification transactions in an operational system in which one or more subjects are identified

4.16
system rejection rate
proportion of recognition transactions in an operational system in which the subject is not recognized

NOTE The system rejection rate differs from the false reject rate in that, in addition to false rejections, it also includes any rejected impostor transaction and any improper genuine transaction.

4.17
test crew member
selected biometric data subject whose use of the operational system is controlled or monitored as part of the evaluation

NOTE In an operational evaluation, test subjects can be subjects of the operational system or they can be members of a test crew using the system specifically for evaluation purposes

5 Operational evaluation overview

5.1 Operational evaluation goals

The overarching goals of operational testing are to measure or monitor operational biometric system performance.

Subgoals of operational testing may include:

— to determine if performance meets the requirements specified for a particular application or the claims asserted by the supplier;

— to determine the need to adjust or configure the system to improve performance;

— to predict performance as the numbers of subjects, locations, or devices increase;

— to obtain information on the target population and environmental parameters found to affect system performance;

— to obtain performance data from a pilot implementation;

— to obtain performance data to benchmark future systems.

Operational evaluation considers the performance of people as well as the equipment, algorithms, and environment. Consequently, operational testing includes aspects of social science in addition to physical science, whereas technology testing does not. In general, operational performance will vary over time due to uncontrolled conditions in people, equipment and environment. For example, if the majority of subjects are enrolled at the start of operations, with few new enrolments, performance of the system might improve as

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subjects habituate or degrade as subjects' biometric characteristics age over time away from their enrolled references.

The performance observed in testing can depend on the operational personnel, such as attendants or biometric examiners, as well as the biometric subjects. Operational personnel based factors should be taken into consideration in all aspects of the test from scope definition to reporting (see e.g., references [1] and [2]).

5.2 Operational performance metrics

Recognition metrics for operational testing differ from those used in technology and scenario testing. In technology and scenario tests, false accept and false reject rates can be measured because the underlying ground truth is known to the experimenters. Ground truth will generally be unknown in an operational setting such that an operational test will measure system acceptance and system rejection rates.

Determining the false accept rate and false reject rate from the number of system rejections and acceptances will require additional observations or controls to determine the legitimacy of identity claims and device interactions. Similarly, in the case of identification systems, determining identification error rates from the number of system identifications also requires additional observations or controls.

Performance calculations in technology and scenario tests often exclude rejections in which the subject did not provide an ideal presentation or did not correctly follow instructions. Operational testing will include such rejections in measuring the system rejection rate.

5.3 Operational evaluation methods

Operational performance assessment is based on data collected through an operational system. A system may be configured in "evaluation mode" to collect additional data during normal system use.

Operational performance assessment may be based upon different groups of test subjects:

— data collected with a non-controlled set of test subjects (i.e., a set of test subjects reflective of the subject base of the operational system);

— data collected with a controlled set of test subjects defined as the "test crew members" (i.e., a set of test subjects considered and controlled separately from the subject base of the operational system).

If the test crew is specially instructed in their use of the system, evaluation results can be expected to differ from those encountered operationally. Operational performance can be highly time variant because of uncontrollable variations in the population, equipment and environment. Variation in performance across these conditions cannot be predicted.

5.4 Determining operational performance

Performance estimates may be determined from operational data in at least three ways:

— through direct observation of throughput rates, acceptance rates and/or rejection rates;

— through offline computation of throughput and acceptance and rejection rates based on comparison scores and timing metrics recorded during operations; and

— through offline computation of comparison scores, and acceptance and rejection rates based on samples acquired during the test and on stored reference data.

Each approach is likely to yield different measures. Further, each approach carries different risks for miscalculation. For example, recording only direct observations of an access control system does not reveal whether a rejection was due to a biometric error or an error in the operation of the gate; recording only comparison scores will not show cases where a reference or probe has been stored or transmitted incorrectly.

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5.5 Use of technology and scenario evaluation methodologies in evaluating operational systems

In addition to tests based on real operational use of the system, scenario and technology evaluation (ISO/IEC 19795-2 [3]) can also have a role in determining some aspects of operational performance.

Testing solely in live operation might not be capable of measuring all aspects of operational performance. Depending on the purpose of the evaluation, certain performance measures might only be determined by testing for them specifically. Testing in live operation is not meant to guarantee that the system will be operating under the specific conditions, or with sufficient frequency, in order to draw statistically valid conclusions. Furthermore, when testing operationally, it might be infeasible to isolate these effects from other operational factors that also affect performance.

EXAMPLE Environmental factors such as sunlight or humidity can affect sensor performance. Unless the system is tested to monitor performance in the specific environments, the effects that such factors have on the operational performance cannot be quantified.

6 Operational evaluation

6.1 Purpose and scope

6.1.1 General

The purpose and scope of the test need to be determined before the test design can be drawn up. The following elements shall be addressed:

— criteria for system inclusion,

— system specification,

— enrolment and comparison functionality to be evaluated, and

— performance measures of interest.

6.1.2 Criteria for system inclusion

The experimenter shall address the criteria by which biometric system(s) are included in an operational test. Biometric systems may be included in an operational test due to their having been previously deployed, due to selection on the part of the biometric system operator, or due to selection on the part of the evaluating entity.

NOTE Testing multiple independent systems could compromise the operational realism of the tests. However, some elements of the test must be controlled if meaningful comparisons are to be made. Some elements can be controlled without jeopardizing the operational value of the tests. (See reference [4].)

6.1.3 System specification

Details of the system under test shall be specified as fully as possible. The following elements should be reported:

— for acquisition devices: manufacturer, model, version, and firmware version as applicable — if the acquisition device's core acquisition components are integrated within a third-party device, such as in the case of a fingerprint sensor incorporated into a peripheral, then manufacturer, model, version, and firmware of the core acquisition components and those of the peripheral shall be reported;

— for biometric algorithms: provider, version, and revisions, and the values of all field-variable parameters or settings — biometric algorithms include quality assessment, feature extraction, binning, comparison and fusion algorithms, and any or all of these might be supplied by different vendors;

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