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Information technology — Evaluation methodology for environmental influence in biometric system performance

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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.

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Information technology — Evaluation methodology for environmental influence in biometric system performance

Technologies de l'information — Méthodologie de l'évaluation de l'influence environnementale dans la performance d'un système biométrique

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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.

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).

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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*, SC 37, *Biometrics*.

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Introduction

The performance of biometric systems can vary according to environmental conditions (see e.g. ISO/IEC 19795-1:2006, C.2.6, ISO/IEC TR 19795-3:2007, Table 4). Environmental conditions can affect subjects' ease of use and comfort in using the systems, subjects' biometric characteristics, and also the devices used for acquisition of biometric samples.

This International Standard provides a generic methodology to analyse the influence of environmental conditions on biometric system performance.

NOTE Environmental conditions can affect several elements involved in the recognition process. However, the proposed evaluation methodology does not distinguish which of them is affected. The intention of this methodology is to quantify the overall influence analysing the biometric system performance.

For this International Standard, environmental conditions has to be understood as all atmospheric parameters (e.g. temperature, humidity) and other physical and chemical phenomena (e.g. illumination, noise) that can surround the biometric system and influence in its performance. Certain environmental conditions such as vibration are not dealt with in this International Standard.

These evaluations consist of carrying out a similar "end-to-end" biometric performance evaluation in one or more predefined environments. These environments can be real (naturally occurring) or modelled (artificially controlled).

There are two possible ways to carry out an "end-to-end" biometric performance evaluation: performing scenario evaluations or operational evaluations. In scenario evaluations, biometric systems are assessed in modelled environments considering a real-world target application and population. These evaluations are specified as a special case of scenario test based on ISO/IEC 19795-2. An evaluation performed in a controlled environment can be reproducible, unlike in an operational environment which uncontrolled parameters can affect the system. In operational evaluations, biometric systems are analysed in real environments using a target population. These evaluations are specified as a special case of operational evaluations based on ISO/IEC 19795-6. Operational testing can lack the precision of scenario testing (in terms of the levels of the environmental parameters), but the testing will benefit in terms of being operationally realistic. This International Standard provides testing requirements specific to environmental testing for both kinds of evaluations.

The methodology addresses how to test several environmental factors; however, an evaluation that conforms to this International Standard can consider as few as one single environmental parameter. The test parameter or parameters to assess and control has to be previously defined by participants involved in the evaluation.

The targets of this kind of evaluations include:

— Analyse how one or a combination of environmental factors can affect the biometric system performance and quantify this influence.

— Analyse how a biometric system works in a specific controlled environment, compared to the same system working in a reference evaluation environment.

— Analyse how a biometric system behaves in a real environment compared to the same system working in a modelled environment simulating the operational environment.

The results of these evaluations can inform suppliers and users so that they can assess which environmental conditions are likely to affect the performance of a biometric system under conditions they expect to encounter. Results can also indicate whether the particular biometric modality and method of implementation is appropriate for the situation under which the system is expected to be used. Also this methodology can be used for examining environmental parameters under which biometric systems poorly.

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INTERNATIONAL STANDARD ISO/IEC 29197:2015(E)

Information technology — Evaluation methodology for environmental influence in biometric system performance

1 Scope

This International Standard addresses

— fundamental requirements for planning and execution of environmental performance evaluations for biometric systems based on scenario and operational test methodologies,

— specifications to define, establish, and measure specific conditions to assess, including requirements for equipment,

— requirements for establishing a baseline performance in order to compare the influence of environmental parameters,

— a specification of the biometric evaluation including requirements for test population, test protocols, data to record, and test results, and

— procedures for carrying out the overall evaluation.

This International Standard does not

— determine which parameters should be analysed for a specific biometric modality (This is currently covered in ISO/IEC/TR 19795-3.),

— specify requirements to perform a vulnerability analysis modifying environmental factors (This is covered by ISO/IEC 19792.),

— classify biometric systems upon performance against different environmental conditions, or

— specify requirements for determining the functional effects of environmental conditions on hardware components (such as corrosion, electrical interference, breakage, etc.) of biometric systems.

2 Conformance

Environmental tests of biometric systems shall be based on scenario evaluations or operational evaluations. Scenario evaluations shall conform with mandatory requirements of Clause 7 whereas operational evaluations shall conform with mandatory requirements of Clause 8.

Further, a scenario evaluation that conforms to this International Standard shall analyse at least two evaluation conditions: the reference evaluation environment and one target evaluation environment. Both shall consider at least one environmental parameter to assess such as temperature, humidity, illumination, etc. These evaluation conditions shall be selected, specified, measured, and recorded in accordance with Clause 6.

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 19795-1:2006, *Information technology — Biometric performance testing and reporting — Part 1: Principles and framework*

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

ISO/IEC 19795-6, *Information technology — Biometric performance testing and reporting — Part 6: Testing methodologies for operational evaluation*

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
ambient conditions
real environment
common, prevailing, and uncontrolled atmospheric and weather conditions in a room or place

Note 1 to entry: A test described as "conducted at ambient conditions" was performed at whatever conditions were prevailing at that time on that day.

4.2
baseline performance
performance of a biometric system in a reference evaluation environment

4.3
controlled conditions
climatic and physical conditions that are constrained or managed or kept within certain bounds for the testing purpose

4.4
environment generator
specialized test equipment used to establish and maintain the controlled conditions of the test

4.5
environmental conditions
all atmospheric parameters (e.g. temperature, humidity) and other physical and chemical phenomena (e.g. illumination) that can surround the biometric system and influence in its performance

Note 1 to entry: These can be controlled or ambient.

4.6
evaluation condition
environmental condition under which an evaluation is executed

4.7
evaluation configuration
physical layout of the environment in which the biometric system is going to be tested including the necessary equipment and test instruments for performing tests

4.8
evaluation environment
environment in which the biometric system is evaluated considering the environmental conditions and the evaluation configuration

4.9
extreme condition
condition that entails very high or very low values of the environmental parameters and may be hostile for systems operation or even human life

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4.10
instrument
calibrated equipment used to measure and/or record environmental parameters (such as temperature, humidity, illumination, and sound)

Note 1 to entry: In some cases, instruments have the integrated capability of both measuring and recording parameters in one piece of equipment.

4.11
measuring point
specific value for an environmental parameter that is being assessed

4.12
operational environment
conditions under which the biometric system is expected to operate

Note 1 to entry: This is a combination of environmental factors and operational procedures.

4.13
reference evaluation environment
evaluation environment in which the biometric system is analysed to obtain baseline performance metrics

4.14
set point
specific value for an environmental parameter that is being controlled

4.15
target evaluation environment
evaluation environment in which the biometric system is analysed to obtain performance metrics for studying the influence of certain environmental conditions

5 Overview

5.1 Introduction

An environmental evaluation is a set of trials carried out to analyse the biometric performance of one or more biometric systems working in particular environmental conditions to determine the effect of one or more of the conditions. These may be executed as one of two types of biometric evaluations: scenario evaluations and operational evaluations. Scenario evaluations analyse “end to end” biometric system performance in a modelled environment whereas operational evaluations analyse “end to end” biometric system performance in an uncontrolled operational environment.

Once the biometric evaluation is carried out in each of the different evaluation conditions, a group of performance metrics will be calculated. These metrics are specific for these evaluation conditions.

The number of evaluation conditions to analyse will depend on the following aspects:

— if the evaluation environment is real or modelled and how many variations of environmental parameters are feasible;

— if the objective is analysing the influence of one or more environmental parameters separately and how many measuring points are going to be examined per each parameter;

— if the objective is checking how a biometric system works in a particular environment.

These aspects are not independent. A decision on conducting a scenario or operational evaluation will depend upon the objectives of the environmental evaluation, the number of parameters to assess, and whether the environment is real or modelled. The following subclauses describe both kinds of environmental evaluations and their main characteristics.

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