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Information technology — Scenario evaluation methodology for user interaction influence in biometric system performance

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Contents

Foreword

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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 or www.iec.ch/members _experts/refdocs).

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national -committees.

Introduction

This document describes a methodology for testing and reporting user interaction influence on the performance of biometric recognition systems. Specifically, it describes a methodology for testing and reporting that influence.

The performance of biometric systems can vary or can be influenced by user interaction influence factors. According to 19795-1:2006, C.2, user physiology, user behaviour, sensors and hardware (all user interaction influence factors) are some factors that can influence the performance of a biometric system.

This methodology is a scenario test in which a set of test subjects interacts with a biometric system to execute transactions when one or more of the following factors is controlled:

— Factors related to the design, position or condition of the capture system.

— Factors depending on the users and their attributes.

— Factors depending on the user interaction with the biometric system.

Testing user interaction influence can be subjective and is not necessarily straightforward. Therefore, this document is intended to address the main conflicts that arise in such cases.

Within the context of this document, it is important to differentiate between "usability testing" and "user interaction influence in performance". Usability testing relates to "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO/IEC 9241-11:2018). Usability testing involves the measurement of "how usable" a specific system or product is. Usability testing is addressed in documents including ISO/IEC TR 25060. On the other hand, "user interaction influence in performance" deals with measuring how the performance of a biometric system can differ from a reference evaluation, based on subjects using the system in operational or scenario conditions.

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Information technology — Scenario evaluation methodology for user interaction influence in biometric system performance

1 Scope

This document addresses:

— requirements for planning, executing and reporting the influence of user interaction on biometric system performance based on scenario test methodologies, considering three kinds of factors:

    a) factors related to the design, position or condition of the capture device,

    b) factors depending on users and user attributes,

    c) factors depending on the interaction of users with the biometric system;

— specifications for the definition, establishment and measurement of conditions needed for evaluation, including those relating to equipment;

— requirements for establishing a reference evaluation condition (REC) and target evaluation condition(s) (TEC) to compare the influence of user interaction factors;

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

— procedures for carrying out the overall evaluation.

This document does not

— determine which parameters ought to be analysed for a specific biometric modality. This is currently covered in ISO/IEC TR 19795-3;

— specify requirements for performing a vulnerability analysis modifying user interaction influence factors;

— include procedures for performing usability testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2382-37, *Information technology — Vocabulary — Part 37: Biometrics*

ISO/IEC 24779 (all parts), *Information technology — Cross-jurisdictional and societal aspects of implementation of biometric technologies — Pictograms, icons and symbols for use with biometric systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19795-1, ISO/IEC 2382-37 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
reference evaluation condition
REC
test condition reflecting established device factors, user factors or user interaction factors

Note 1 to entry: Results generated under these test conditions are compared against results generated under corresponding *target evaluation conditions* (3.2).

3.2
target evaluation condition
TEC
test condition reflecting new or alternative device factors, user factors or user interaction factors

Note 1 to entry: Results generated under these test conditions are compared against results generated under corresponding *reference evaluation conditions* (3.1).

3.3
user interaction influence in performance
measurement of how the performance of a biometric system can differ from a reference evaluation, based on subjects using the system in operational or scenario conditions

3.4
usability testing
testing relating to the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

Note 1 to entry: See ISO/IEC 9241-11.

4 Conformance

To conform to this document, a user interaction influence performance evaluation shall implement the requirements contained herein, including one reference evaluation condition (REC) and at least one target evaluation condition (TEC).

5 Overview

5.1 General

Testing the influence of user interaction in the performance of a biometric system entails execution of one scenario evaluation under reference evaluation conditions (REC) and at least one evaluation under target evaluation conditions (TEC). These evaluations are identical except for changes to the user interaction influence factors being studied.

For each set of condition(s), test subjects interact with the biometric system as many times as required. The number of times the interaction is repeated shall be defined at the time of the evaluation design, considering parameters such as: available time for the evaluation, availability of test crew, effort to be applied for each test crew subject, cost, etc. Biometric system recognition outcomes and (optionally)

test subject interactions are recorded. From such results, it is possible to calculate biometric system performance (e.g. error rates and throughput rates) for the specific evaluation condition(s).

By comparing performance results generated under REC and TEC, the influence associated with user interaction factor(s) can be quantified. A schema of the evaluation methodology model is shown in Figure 1. In scenario evaluations, biometric systems are assessed in modelled environments considering a real-world target application and population. Requirements for scenario testing and reporting are defined in ISO/IEC 19795-2.
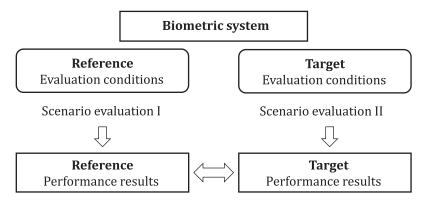

Figure 1 — Methodology evaluation schema of user interaction influence in biometric system performance

Each evaluation condition is specified to analyse one or a combination of user interaction influence factors. The evaluation methodology allows for conditions to be tailored according to the objectives of the evaluation. These objectives can consider three general aspects:

— the design, position or condition of the biometric system and/or its biometric capture device;

— the potential users, their attributes or the state of such attributes;

— parameters that can affect the interaction process such as guidance, training or feedback.

Depending on the biometric system, its capture device, the potential users and the final application, certain aspects are more critical than others. ISO/IEC TR 19795-3 discusses modality-specific aspects that can be relevant to user interaction influence testing. Parties involved in the evaluation shall select which aspects are indispensable for analysis. TEC can encompass one or multiple user interaction influence factors.

5.2   User interaction influence factors

In order to compare TECs and RECs, it is also necessary to define the user interaction influence factors. There are three kinds of factors in the interaction between users and biometric systems:

— Factors depending on the biometric capture device, e.g. design, position or condition.

— Factors depending on users and user attributes, e.g. physical features or experience with the device.

— Factors depending on the interaction of users with the biometric system, e.g. feedback provided by device to user.

6 Evaluation conditions specification

6.1 General

The individual(s) carrying out the experiment shall specify the user interaction influence conditions to be evaluated, taking into consideration the following:

— user interaction influence factors;

— RECs and TECs;

— enrolment and recognition-based factors.

6.2 Specification of user interaction influence factors

6.2.1 General

The definition of the evaluation conditions consists of determining which user interaction influence factors will be assessed. The different kinds of factors that can be selected are provided in the following subclauses. Other factors that can be measured may be considered.

6.2.2 Factors depending on the biometric system

User interaction can be influenced by the design, position or condition of the biometric capture system. These factors, examples of which are listed in Table 1, can cause the failure of the biometric capture process or result in a biometric sample of poor quality. Table 1 categorizes factors as software- and hardware-related, and includes an example for each factor and/or its possible variations.

Table 1 — Examples of system-dependent user interaction influence factors

Type	Factor			Example REC	Example TEC 1	Example TEC 2
Software	Process	Location		Remote server-based matching	Embedded matching	
Hardware	Position	Height		Device positioned at 1,20 m height	Device positioned at 1 m height	Device positioned at 1,50 m height
		Orientation	Rotation	Swipe sensor horizontally	Swipe sensor vertically	
			Incline	On a table without inclination	On a table with 15º inclination	On a table with 30º inclination
		Mobility		Attached to a wall	Embedded in a mobile device	
	Condition			Clean sensor	Dirty sensor	

6.2.3 Factors depending on the user

The users' attributes (including biometrics) can also affect the process of capturing the biometric sample. User interaction influence factors can be associated with a test subject (i.e. the person who presents biometric characteristics).

In this document, the users are the participants of the evaluations or the personnel who interact with the biometric devices/system (depending on the evaluation characteristics). Guidance on best practice and on how to measure the operators' influence in the evaluations' performance is provided in ISO/IEC TR 29189. Further information on the accessibility and usability of biometric systems is given in ISO/IEC TR 24714-1 and in ISO/IEC TR 29194.

Table 2 categorizes user interaction influence factors as behavioural and physical and includes illustrative examples of REC and TEC. The categorization into behavioural and physical types, as well

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as the classification of factors, is for illustration only. Again, these factors can cause the failure of the biometric capture process or result in a biometric sample of poor quality.

Table 2 — User interaction influence factors depending on the user

Type	Factor		Example REC	Example TEC 1	Example TEC 2
Behavioural	Speech	Language	Speakers from Spain speaking Spanish	Speakers from Mexico speaking Spanish	Speakers from China speaking Spanish
		Voice	Speakers talking at a certain volume	Speakers talking louder	Speakers with regional dialects
	Movements		Users showing neutral expression	Users smiling	
	Experience		Users habituated to using the system	Users non-habituated to using the system	
	Knowledge		Users who do not have technical knowledge	Users who have technical knowledge	Users who have biometrics knowledge