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Information technology — Biometric performance testing and reporting —

Part 2: Testing methodologies for technology and scenario evaluation

AMENDMENT 1: Testing of multimodal biometric implementations

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

Partie 2: Méthodologies d'essai pour l'évaluation des technologies et du scénario

AMENDEMENT 1: Essais des mises en oeuvre biométriques multimodales

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Foreword

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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*, Subcommittee SC 37, *Biometrics*.

Introduction

Testing and reporting methods in this part of ISO/IEC 19795 are primarily intended for single-modality systems. These standards can be inadequate for executing reproducible performance evaluations of multimodal biometric systems such as those used in border control applications. Various configurations are proposed for multimodal biometric systems, as described in ISO/IEC TR 24722. It is necessary to clearly identify methods and requirements for multimodal biometric systems evaluation such as variation of parameters and environmental factors that are to be described when reporting.

Information technology — Biometric performance testing and reporting —

Part 2: Testing methodologies for technology and scenario evaluation

AMENDMENT 1: Testing of multimodal biometric implementations

Add the following items to the list in the scope clause of ISO/IEC 19795-2*:*

— multimodal biometric specific requirements for technology evaluation and scenario evaluation;

— description of the structure and performance measures of multimodal biometric devices and systems;

— specification of biometric data collection and performance calculation methods;

— specification of reporting requirements.

Add the following item to the definitions clause in this part of ISO/IEC 19795*:*

4.4.2

multimodal FTE

MFTE

proportion of the population for whom the multimodal biometric system with a stated enrolment policy fails to complete the enrolment process

EXAMPLE 1 For a policy which allows one of a set of modalities to be enrolled, MFTE would be the proportion of subjects that fail to enrol in all the modalities. This results in lower effective FTE.

EXAMPLE 2 For a policy which requires enrolment in all considered modalities, MFTE would be the proportion of subjects that fail to enrol in one or more modalities. This results in an effective FTE greater than or equal to the higher of the individual modality FTEs.

Insert the following normative Annex into this part of ISO/IEC 19795:

Annex F
(normative)
Testing of multimodal biometric implementations

F.1 General

This annex specifies methods for evaluating and reporting the performance of multimodal biometric algorithms and systems.

Multimodal biometric implementations might be used to meet the following objectives:

— to support users who cannot present one or more requested modalities to the system, in other words, to improve failure-to-enrol rate;

— to improve biometric system throughput;

— to improve recognition performance (e.g. through reduction of false negative identification rates);

— to improve usability; and

— to increase robustness against presentation attacks.

ISO/IEC TR 24722 defines the following multimodal fusion levels:

— decision-level;

— score-level;

— feature-level;

— sample-level.

Multimodal fusion implementations differ across each level. Even when multimodal data are gathered with identical sensors, results might differ based the fusion level implemented.

For this reason, the experimenter shall determine the system or application to be evaluated. An evaluation shall clearly identify the fusion level implemented, the components of the multimodal implementation, and requirements applicable to evaluations for each fusion level.

Two types of multimodal evaluations can be considered:

— evaluations in which the experimenter does require insight into the multimodal system;

— evaluations in which the experimenter does not require insight into the integrated multimodal system.

This annex focuses on evaluations in which the experimenter requires insight into the multimodal system. F.1 and F.6 are applicable to all multimodal implementations. If the experimenter does not require insight into the integrated multimodal system component shown in Figure F.2 or Figure F.4, then the multimodal implementation can be tested without using this annex.

F.2 Fusion scheme identification information for repeatable evaluation

F.2.1 Decision-level fusion

F.2.1.1 General

An example of decision-level fusion is shown in Figure F.1. Decision-level fusion systems combine decision results from separate biometric sub systems.

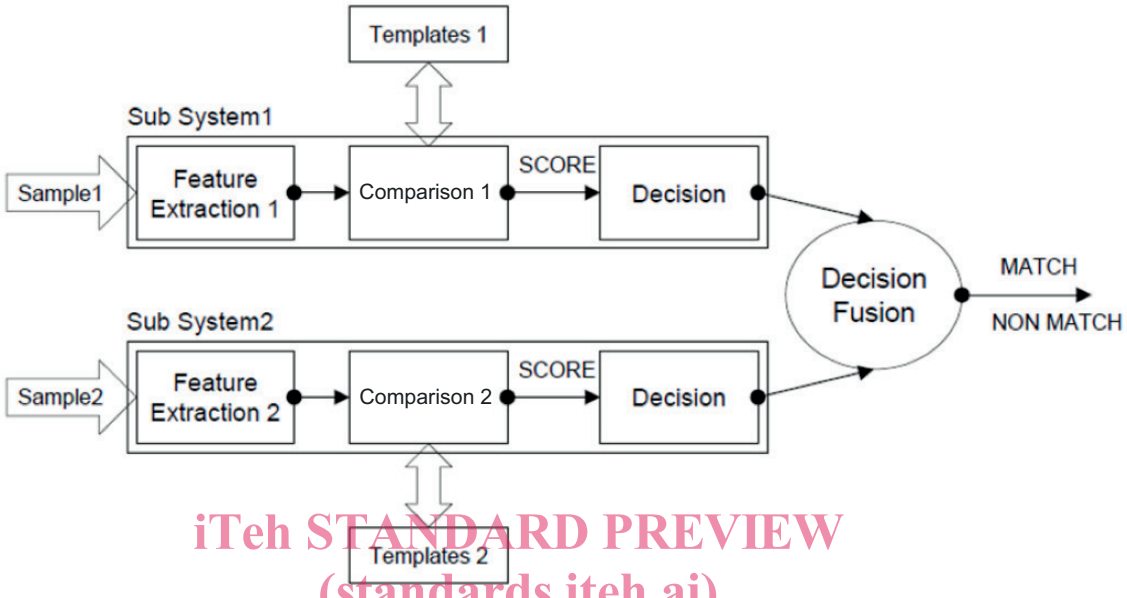

Figure F.1 — Decision-level fusion

NOTE Decision-level fusion systems might be used to improve false match rate (FMR) or false non-match rate (FNMR).

Figure F.2 is an example of an integrated multimodal system with a decision output in which insight is not provided into the implementation. This type of system can be tested without methods described in this annex.

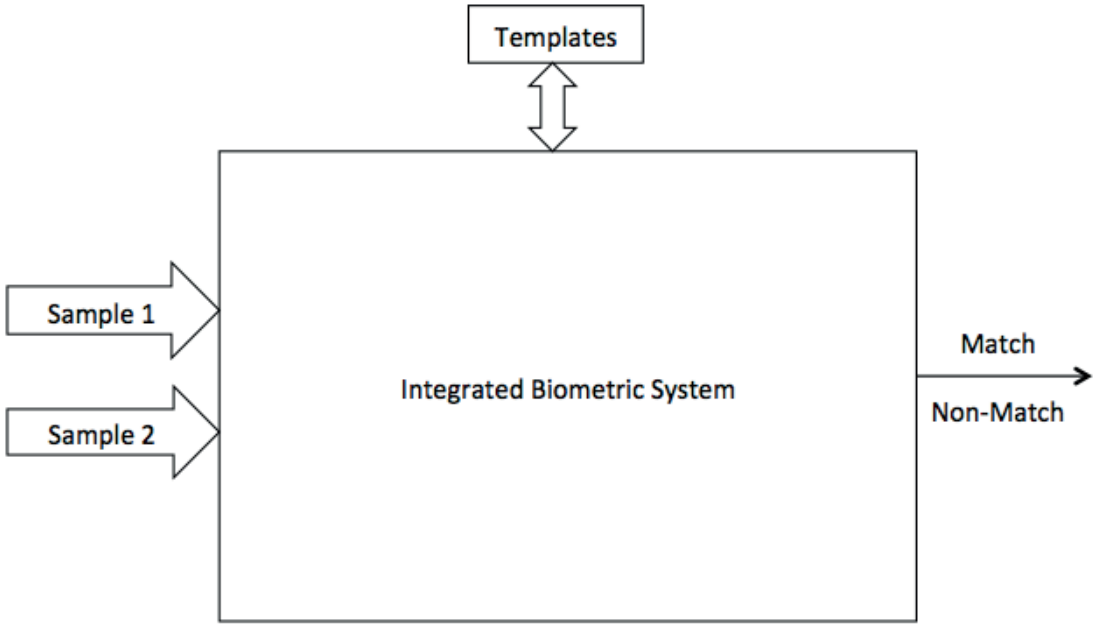

Figure F.2 — Fusion in an integrated multimodal system with decision output

F.2.1.2 Technology evaluation

Requirements for repeatability of decision-level fusion technology evaluation results are as follows:

— the decision fusion logic shall be identical;

— the function configurations (i.e. feature extraction, comparison, and decision) of Sub System 1 and Sub System 2, respectively, shall remain consistent across all tests;

NOTE 1 Sub System 1 and Sub System 2 can have different function configurations, and user-specific thresholds can differ for different users.

— the combination of Sample 1 and Sample 2 fed into each feature extraction function shall be identical;

— the combination of Template 1 and Template 2 shall be identical.

Consistent data selection methods for samples and templates are also required for evaluation repeatability.

If Sub System 1 and Sub System 2 are independent and separate, the evaluation report should include the following:

— identifying information for Sub System 1 and Sub System 2;

— identifying information for decision fusion logic;

— fusion level.

NOTE 2 See 6.4.2.

F.2.1.3 Scenario evaluation

Requirements for repeatability of decision-level fusion evaluation results are as follows:

— the function configurations (i.e. capture, feature extraction, comparison, and decision) of Sub System 1 and Sub System 2, respectively, shall remain consistent across all tests;

NOTE 1 Sub System 1 and Sub System 2 can have different function configurations, and user-specific thresholds may differ for different users.

— the decision fusion logic shall be identical;

— the combination of Sample 1 and Sample 2 fed into each feature extraction function shall be based on the same subject and position (e.g. right iris);

— the combination of Template 1 and Template 2 shall be based on the same subject and position.

Consistent data selection methods for samples and templates are also required for evaluation repeatability.

If Sub System 1 and Sub System 2 are independent and separate, the evaluation report should include the following:

— identifying information for Sub System 1 and Sub System 2;

— identifying information for decision fusion function;

— fusion level.

NOTE 2 See 7.4.2.

F.2.2 Score-level fusion

F.2.2.1 General

Fusion on the score level is illustrated in Figure F.3. Score-level fusion systems utilize score results from separate biometric subsystems.

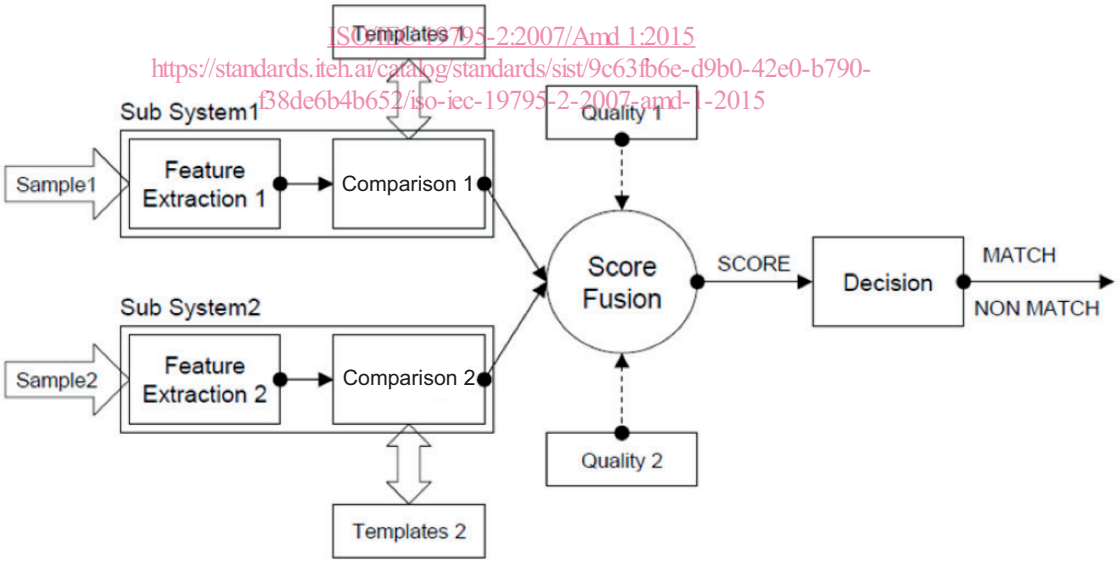

Figure F.3 — Score-level fusion

Score-level fusion may use sample quality in scenario or technology evaluations.

NOTE 1 Score-level fusion systems might be used to improve false match rate (FMR) and false non-match rate (FNMR).

Figure F.4 is an example of an integrated multimodal system with a score output in which insight is not provided into the implementation. This type of system can be tested without methods described in this annex.

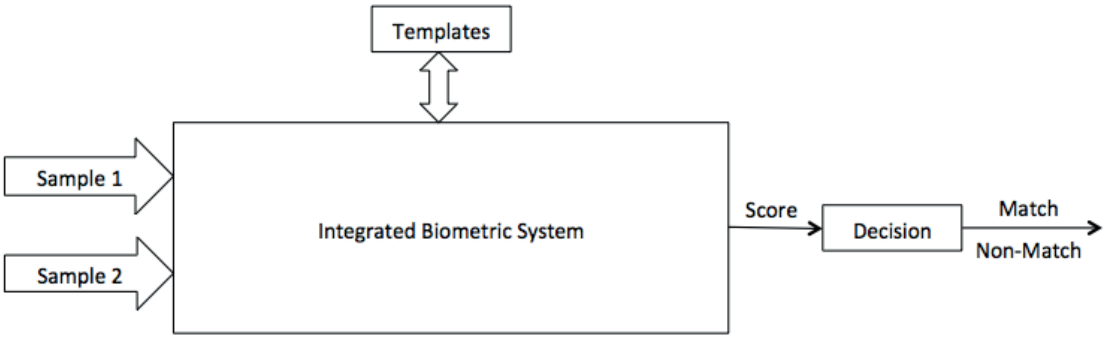

Figure F.4 — Fusion in an integrated multimodal system with score output

F.2.2.2 Technology evaluation

Requirements for repeatability of score-level fusion technology evaluation results are as follows:

— the score fusion function and decision function shall be identical;

— the function configurations (i.e. feature extraction and comparison) of Sub System 1 and Sub System 2, respectively, shall remain consistent across all tests;

NOTE 1 Sub System 1 and Sub System 2 can have different function configurations, and user-specific thresholds might differ for different users.

— the combination of Template 1 and Template 2 shall be identical;

— the combination of Sample 1 and Sample 2 fed into each feature extraction function shall be identical.

Requirements will be necessary for the data selection method for samples and templates, in order to keep repeatability.

If Sub System 1 and Sub System 2 are independent and separate, the evaluation report should include the following:

— identifying information for Sub System 1 and Sub System 2;

— identifying information for score fusion function and decision function;

— fusion level.

NOTE 2 See 6.4.2.

F.2.2.3 Scenario evaluation

Requirements for repeatability of score-level fusion scenario evaluation results can be stated as follows:

— the function configurations (i.e. capture, feature extraction, and comparison) of Sub System 1 and Sub System 2, respectively, shall remain consistent across all tests;

NOTE 1 Sub System 1 and Sub System 2 can have different function configurations, and user-specific thresholds can differ for different users.

— the score fusion function and decision function shall be identical;

— the combination of Template 1 and Template 2 shall be based on the same subject and position;

— the combination of Sample 1 and Sample 2 fed into each feature extraction function shall be based on the same subject and position.

Consistent data selection methods for samples and templates are also required for evaluation repeatability.

If Sub System 1 and Sub System 2 are independent and separate, the evaluation report should include the following:

— identifying information for Sub System 1 and Sub System 2;

— identifying information for score fusion function and decision function;

— fusion level.

NOTE 2 See 7.4.2.

F.2.3 Feature-level fusion

F.2.3.1 General

Fusion on the feature level is illustrated in Figure F.5. Feature-level fusion systems utilize results from separate feature extraction components.

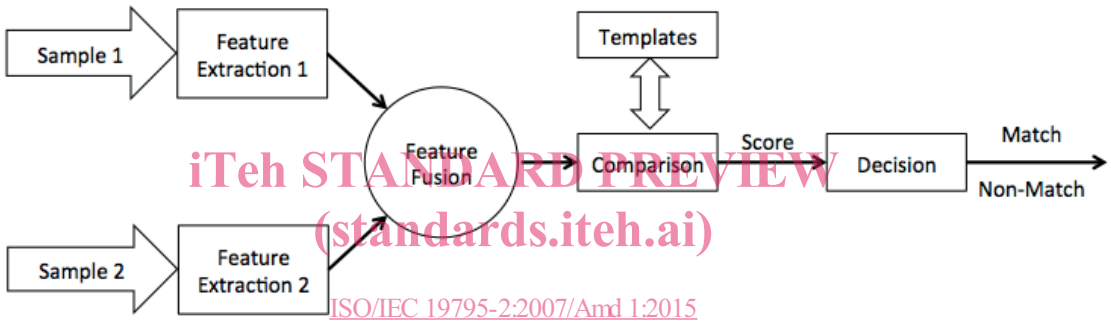

Figure F.5 — Fusion on the feature level

F.2.3.2 Technology evaluation

Requirements for repeatability of feature-level fusion technology evaluation results are as follows:

— feature fusion function, comparison function, and decision function shall be identical;

— the function configurations (i.e. feature extraction) of Feature extraction 1 and Feature extraction 2, respectively, shall remain consistent across all tests;

NOTE 1 Feature extraction 1 and Feature extraction 2 can have different function configurations, and user-specific thresholds can differ for different users.

— the combination of Sample 1 and Sample 2 fed into each feature extraction function shall be identical;

— the combination of Sample 1 and Sample 2 at the time of template creation shall be identical.

Consistent data selection methods for samples and templates are also required for evaluation repeatability.

If Feature extraction 1 and Feature extraction 2 are independent and separate, the evaluation report should include the following:

— identifying information for Feature extraction 1 and Feature extraction 2;

— identifying information for feature fusion function, comparison function and decision function;

— fusion level.