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Standard

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**Information technology —
Biometric sample quality —**

**Part 1:
Framework**

*Technologies de l'information — Qualité d'échantillon
biométrique —*

Partie 1: Cadre

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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.

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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

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

This third edition cancels and replaces the second edition (ISO/IEC 29794-1:2016), which has been technically revised.

The main changes are as follows:

- the definitions of “quality”, “quality score”, and “utility” have been aligned with those in ISO/IEC 2382-37:2022;
- methods for evaluating the efficacy of quality assessment algorithms have been added;
- ASN.1 encoding as defined in ISO/IEC 39794-1 is supported.

A list of all parts in the ISO/IEC 29794 series can be found on the ISO and IEC websites.

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

Quality measures are useful for several applications in the field of biometrics. While ISO/IEC 19784-1 specifies a structure and gives guidelines for quality score categorization, this document defines and specifies methodologies for objective and quantitative quality score expression, interpretation and interchange.

This document establishes a framework that facilitates the use of biometric sample quality assessment and scoring tools. The tools are intended to encourage innovation and performance improvements in, and interoperability of, biometric systems generally. The ISO/IEC 29794 series presents several biometric sample quality assessment and scoring tools, the use of which is generally optional but can be determined as mandatory by particular application profiles or specific implementations. The ISO/IEC 29794 series is prepared to accommodate additional parts that address the biometric modes specified by the ISO/IEC 19794 series and the ISO/IEC 39794 series, with part numbers and titles aligning appropriately. However, as this document is intended for use by all biometric modes, a mode does not necessarily need a mode-specific part to make use of quality scores.

Several applications can benefit from the use of biometric sample quality measures. An example is the use of real-time quality feedback as part of the biometric capture process to improve the operational efficiency and performance of a biometric system. Other examples include data fusion for which multiple samples or references are available in the comparison process, either from a single or multiple biometric mode, and hardening systems against presentation attacks using or targeting low quality biometric samples. The association of quality measures with biometric samples is an important component of quality measure standardization. Quality fields as specified in [Clause 7](#) are included in biometric data interchange formats. If a CBEFF (Common Biometric Exchange Formats Framework) header is present, then CBEFF_BDB_quality may additionally be used to express quality measures. Useful analyses can be performed using quality measures along with other data to improve the performance of a biometric system. For example, correlating quality measures to other system metrics can be used to diagnose problems and highlight potential areas of performance improvement.

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Information technology — Biometric sample quality —

Part 1: Framework

1 Scope

This document establishes the following items for any or all biometric sample types as necessary:

- terms and definitions that are useful in the specification and use of quality measures;
- purpose and interpretation of biometric quality scores;
- motivation for developing biometric sample datasets for the purpose of quality score normalization;
- format for exchange of quality assessment algorithm results;
- methods for aggregation of quality scores;
- methods for evaluating the efficiency of quality assessment algorithms.

The following are outside the scope of this document:

- specification of minimum requirements for sample, module, or system quality scores;
- standardization of quality assessment algorithms;
- assessment of utility of biometric samples or references for human examiners.

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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 39794-1, *Information technology — Extensible biometric data interchange formats — Part 1: Framework*

ISO/IEC 2382-37, *Information technology — Vocabulary — Part 37: Biometrics*

ISO/IEC 19785-2, *Information technology — Common Biometric Exchange Formats Framework — Part 2: Biometric registration authority*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 2382-37, ISO/IEC 39794-1 and the following apply.

ISO and IEC maintain terminology 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

acquisition fidelity

fidelity (3.8) of a biometric sample attributed to the acquisition process

3.2

biometric character

set of attributes associated with a biometric characteristic that cannot be controlled during the biometric acquisition process

EXAMPLE Scars, number of minutiae, blepharoptosis (droopy eyelid)

[SOURCE: ISO/IEC 2382-37:2022, 37.09.15, modified — Note 1 to entry has been removed.]

3.3

biometric utility

degree to which a biometric sample supports biometric recognition *performance* (3.11)

Note 1 to entry: The *biometric character* (3.2) of the sample source, the *fidelity* (3.8) of the processed biometric samples and the conformance of the biometric sample presentation contribute to, or similarly detract from, the utility of the biometric sample.

Note 2 to entry: Performance measures such as false match rate, false non-match rate, failure-to-enrol rate, and failure-to-acquire rate are an indication of biometric utility.

[SOURCE: ISO/IEC 2382-37:2022, 37.09.16, modified — “character” has been changed to “biometric character” in Note 1 to entry.]

3.4

environment

physical surroundings and conditions in which the biometric capture takes place

Note 1 to entry: The conditions include the factors such as lighting and temperature, level of enrollee cooperation, and the skill of the operator, if one is involved in the capture process.

3.5

false non-match error versus discard characteristic

FNM-EDC

method to evaluate the efficacy of *quality assessment algorithms* (3.13) by quantifying how efficiently discarding samples with low *quality scores* (3.16) results in an improved (i.e. reduced) false non-match rate

Note 1 to entry: The false non-match error versus discard characteristic is a graphical presentation of the *performance* (3.11) of quality assessment algorithms, plotting the dependence of the false non-match rate at a fixed comparison decision threshold on the percentage of low-quality reference and probe samples discarded.

3.6

false match error versus discard characteristic

FM-EDC

method to evaluate the efficacy of *quality assessment algorithms* (3.13) by quantifying how efficiently discarding samples with low *quality scores* (3.16) results in an improved (i.e. reduced) false match rate

Note 1 to entry: The false match error versus discard characteristic is a graphical presentation of the *performance* (3.11) of quality assessment algorithms, plotting the dependence of the false match rate at a fixed comparison decision threshold on the percentage of low-quality reference and probe samples discarded.

3.7

extraction fidelity

component of the *fidelity* (3.8) of a sample attributed to the biometric feature extraction process

3.8

fidelity

degree to which a biometric sample is representative of its source biometric characteristic

Note 1 to entry: The fidelity of a sample comprises components attributable to one or more of the processing steps: acquisition, extraction, signal processing.

3.9

interpretation

process of analysing a *quality score* (3.16) along with other data in order to give that score contextual, relative meaning

3.10

native quality measure

output of a *quality assessment algorithm* (3.13) without constraints on data format and/or value range

3.11

performance

assessment of false match rate, false non-match rate, failure-to-enrol rate, failure-to-acquire rate, processing time or throughput rates of a biometric system

3.12

quality

degree to which a biometric sample meets the specified requirements for its targeted application

[SOURCE: ISO/IEC 2382-37:2022, 37.09.14]

3.13

quality assessment algorithm

quality algorithm

algorithm to calculate a *quality measure* (3.15)

Note 1 to entry: The ISO/IEC 19785 series uses the term "quality algorithm".

3.14

quality component

measurement on the biometric sample that may contribute to the computation of a unified *quality score* (3.16)

Note 1 to entry: Features expressing quality components are defined in the modality-specific parts of the ISO/IEC 29794 series.

3.15

quality measure

quality score (3.16) or *quality component* (3.14)

3.16

quality score

quantitative value of the fitness of a biometric sample to accomplish or fulfil the comparison decision

[SOURCE: ISO/IEC 2382-37:2022, 37.09.13]

3.17

quality score normalization

rescaling of *quality scores* (3.16) to improve consistency in scale and *interpretation* (3.9)

3.18

quality score normalization dataset

QSND

dataset of biometric samples annotated with *quality scores* (3.16) for use in *quality score normalization* (3.17)

Note 1 to entry: Target quality scores may be assigned based on *performance* (3.11) outcomes using the sample in question or may be based on quality factors recorded in the acquisition of the dataset.

3.19

quality score percentile rank

QSPR

percentile rank of *quality scores* (3.16) of biometric samples in an identified control dataset that are less than the specified quality score

Note 1 to entry: See *QSND* (3.18).

3.20

raw quality score

quality score (3.16) that has not been *interpreted* (3.9), either by the creator or recipient of the score, and alone potentially does not intrinsically provide contextual information

4 Abbreviated terms

| | |
|-------|---|
| BDB | biometric data block |
| CBEFF | common biometric exchange formats framework (ISO/IEC 19785) |
| CDF | cumulative distribution function |
| DET | detection error trade-off |
| FERET | facial image database developed by the U.S. government in the 1990s |
| FMR | false match rate |
| FNMR | false non-match rate |
| QAID | quality assessment algorithm identifier |
| QSND | quality score normalization dataset |
| QSPR | quality score percentile rank |
| QVID | quality assessment algorithm vendor identifier |

5 Conformance

A biometric sample quality block shall be considered conformant to this document if its structure and data values conform to the formatting requirements of [Clause 7](#).

The semantic conformance testing will be handled in the modality-specific parts of the ISO/IEC 29794 series, where, for example, conformance test sets (a set of biometric samples representing the entire variety of quality from poor to good) and associated quality scores to be obtained with the reference implementation are given.

6 Biometric sample quality criteria

6.1 Reference model

In biometrics, the term “quality” is used to describe several different aspects of a biometric sample that contribute to the overall performance of a biometric system. For the purposes of standardization, this document defines terms, definitions, and a reference model for distinguishing among the different aspects of quality, illustrated in [Figure 1](#). The quality of a biometric sample depends on character and fidelity. [Figure 2](#) illustrates the relationship between quality (character, fidelity and utility) and system performance. The utility of a biometric sample reflects the impact of this sample on biometric recognition performance.

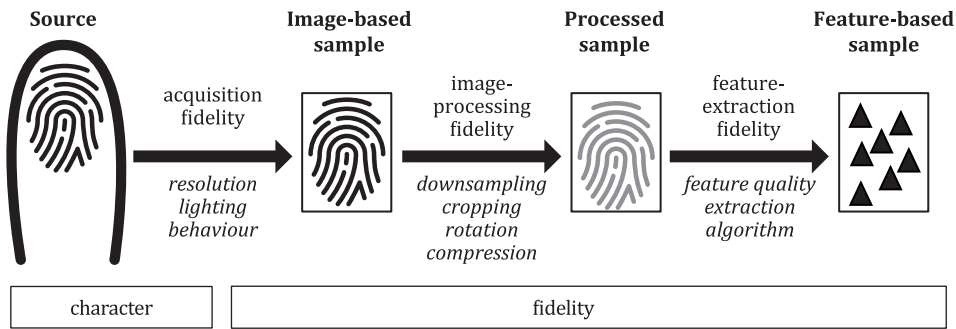


Figure 1 — Quality reference model illustration

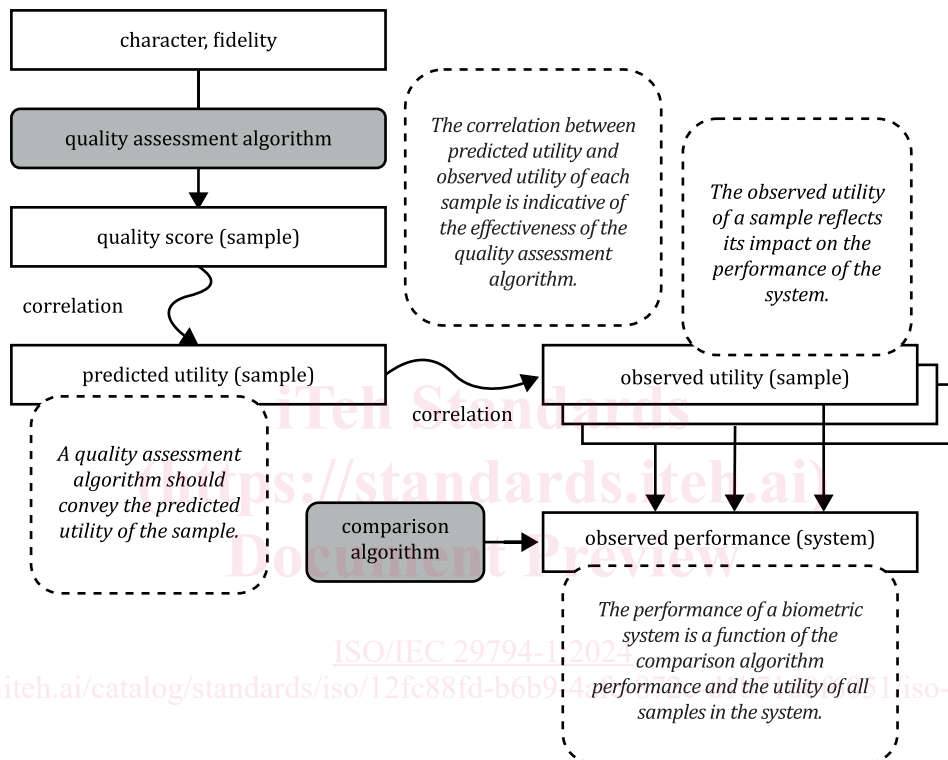


Figure 2 — Relationship between quality and system performance

6.2 Quality aspects: character, fidelity, utility

The term “quality” as it is currently used in the field of biometrics has several connotations, depending on context. Three prevalent uses subjectively reflect the following.

- Character of a sample — An expression of quality based on the inherent properties of the biometric characteristic from which the biometric sample is derived. For example, worn friction ridges have poor character and blepharoptosis (droopy eyelid) causes poor iris character.
- Fidelity of a sample to the biometric characteristic from which it is derived — An expression of quality based on fidelity reflects how accurately the sample represents its biometric characteristic. Sample fidelity is comprised of fidelity components contributed by different processes.
- Utility of a sample within a biometric system — An expression of quality based on utility reflects the predicted positive or negative contribution of an individual sample to the overall performance of a biometric system. Utility-based quality is dependent on both the character and fidelity of a sample or reference as well as the details of the specific biometric system of which performance is being evaluated. This implies that utility is not necessarily a universal attribute of a sample consistent across all systems.