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Information technology — Biometric sample quality —

Part 5: Face image data

*Technologies de l'information — Qualité d'échantillon biométrique —
Partie 5: Données d'image de face*

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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 TR 29794-5, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

ISO/IEC 29794 consists of the following parts, under the general title *Information technology — Biometric sample quality*:

- *Part 1: Framework*
- *Part 4: Finger image data* [Technical Report]
- *Part 5: Face image data* [Technical Report]

Introduction

The purpose of this part of ISO/IEC 29794 is to define and specify methodologies for computation of objective, quantitative quality scores for facial images. Furthermore, the purpose, intent, and interpretation of face quality scores are defined.

ISO/IEC 19794-5, *Information technology — Biometric data interchange formats — Part 5: Face image data*, already gives some specifications that are related to

- scene constraints of the facial images,
- photographic properties of the facial images, and
- digital image attributes of the facial images.

Within this part of ISO/IEC 29794, a sample of a classification scheme of facial quality is exemplified and approaches for the determination of certain aspects of quality are introduced.

Information technology — Biometric sample quality —

Part 5: Face image data

1 Scope

For aspects of quality specific to facial images, this part of ISO/IEC 29794:

- specifies terms and definitions that are useful in the specification, use and testing of face image quality metrics;
- defines the purpose, intent, and interpretation of face image quality scores.

Performance assessment of quality algorithms and standardization of quality algorithms are outside the scope of this part of ISO/IEC 29794.

2 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 29794-1, *Information technology — Biometric sample quality — Part 1: Framework*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29794-1 and the following apply.

3.1

comparison score

numerical value (or set of values) resulting from a comparison

3.2

face quality assessment algorithm

algorithm that computes a quality score for a given face image sample

3.3

facial image

electronic image-based representation of the portrait of a person

4 Abbreviated terms

CCD Charge-coupled device

DCT Discrete Cosine Transform

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GCF	Global Contrast Factor
FQAA	Face Quality Assessment Algorithm
QS	Quality Score
FQS	Face Quality Score
QSN	Quality Score Normalization

5 Approaches to Face Image Quality

Face Image Quality can be defined in many ways, depending on the application. For the purpose of this part of ISO/IEC 29794 standard Face Image Quality is defined in relation to the use of facial images with automated face recognition systems. The performance of an automated face recognition system is affected by the amount of defect or the degree of imperfection present in the face image. The knowledge of quality can, and is currently being used to, process face images differently, by either invoking some image enhancement or normalization methods prior to feature extraction, invoking different matchers based on quality, or simply changing the threshold. The use of face image quality assessment to enhance the overall performance of the system is increasing [3, 4, 5].

A very important application of real-time quality analysis of faces is Face Recognition in Video, also referred to as Face in a Crowd, Recognition on the move, or Face at a Distance, e.g [21].

This part of ISO/IEC 29794 shows some approaches for estimating Face Image Quality. The aim is to give the reader examples of assessment algorithms. Note, that these algorithms have pros and cons and no one algorithm is likely to be suitable for all facial images. Standardization of these algorithms is out of scope of this part of ISO/IEC 29794.

The following related work is being done in ISO/IEC JTC1 SC37 [1, 2]:

- ISO/IEC 29794-1 suggests the use of Quality Algorithm Identification (QAID), or Quality Score Percentile Rank upon standardization of a Quality Score Normalization Dataset (QSND).

This part of ISO/IEC 29794 adopts the following approach for face sample quality description:

- Specifying characterization of the facial quality and possible defects of face biometric samples in categorized aspects.
- Showing how FQAAs can be used to derive face quality scores (FQSs) related to specific characteristics and associated possible defects. An FQAA typically analyzes a face sample locally at the pixel or feature level and fuses the local analysis results over a global region. An FQS evaluates one or more characteristics and associated potential defects, and provides an indicator of the quality.

A typical approach of a system for generation of quality scores for facial images then takes the atomic FQSs generated by the FQAAs and combines them to a final quality score. The final quality score must predict performance metrics such as either false match or false non-match of an automatic facial image recognition.

6 Categorization of Facial Quality

Different factors affect the quality of the facial image with respect to biometric systems' performance. A successful recognition will be based on the biometric characteristics of the subject and a number of factors that influence these characteristics such as variations (e.g. due to ageing) and the environmental conditions in the acquisition process:

- Influence of subjects characteristics on biometric performance,
- Influence of the acquisition process (including the capturing device) on biometric performance.