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Information technology — Biometric data interchange formats —

Part 5: Face image data

Technologies de l'information — Formats d'échange de données biométriques —

Partie 5: Données d'image de la face

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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.

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 19794-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

ISO/IEC 19794 consists of the following parts, under the general title *Information technology — Biometric data interchange formats*:

— *Part 1: Framework*

— *Part 2: Finger minutiae data*

— *Part 3: Finger pattern spectral data*

— *Part 4: Finger image data*

— *Part 5: Face image data*

— *Part 6: Iris image data*

The following parts are under preparation:

— *Part 7: Signature/sign behavioral data*

— *Part 8: Finger pattern skeletal data*

Introduction

Face images, also commonly referred to as displayed portraits, have been used for many decades to verify identity of persons. In recent years, digital face images are used in many applications including human examination as well as computer automated face recognition. Although photographic formats have been standardized in some cases such as passport and driver license, it is also demanded to define a standard data format of digital face images to allow interoperability among vendors.

This part of ISO/IEC 19794 is intended to provide a Face Image Format for face recognition applications requiring exchange of face image data. The typical applications are:

1) human examination of facial images with sufficient resolution to allow a human examiner to ascertain small features such as moles and scars that might be used to verify identity;

2) human verification of identify by comparison of persons against facial images;

3) computer automated face identification (one-to-many searching);

4) computer automated face verification (one-to-one matching).

To enable many applications on variety of devices, including devices that have the limited resources required for data storage, and to improve face recognition accuracy, this part of ISO/IEC 19794 specifies not only a data format, but also scene constraints (lighting, pose, expression etc), photographic properties (positioning, camera focus etc), digital image attributes (image resolution, image size etc).

Several image types are introduced to define categories that satisfy requirements of some applications. Each requirement is specified for each image type.

The record format specified in this part of ISO/IEC 19794 is designed to be embedded in a CBEFF-compliant structure specified in ISO/IEC 19785. The embedment in the CBEFF structure is described in ISO/IEC 19794-1.

Information technology — Biometric data interchange formats —

Part 5: Face image data

1 Scope

This part of ISO/IEC 19794

- specifies a record format for storing, recording, and transmitting the information from one or more facial images within a CBEFF data structure,
- specifies scene constraints of the facial images,
- specifies photographic properties of the facial images,
- specifies digital image attributes of the facial images.

Each requirement is specified for the following Face Image Types, respectively.

- **Basic:** This is the fundamental Face Image Type that specifies a record format including header and image data. All Face Image Types adhere to the properties of this type. No mandatory scene, photographic and digital requirements are specified for this image type.
- **Frontal:** A Basic Face Image Type that adheres to additional requirements appropriate for frontal face recognition and/or human examination. Two types of Frontal Face Image Types are defined in this document, Full Frontal and Token Frontal (or simply Token).
- **Full Frontal:** A Face Image Type that specifies frontal images with sufficient resolution for human examination as well as reliable computer face recognition. This type of Face Image Type includes the full head with all hair in most cases, as well as neck and shoulders. This image type is suitable for permanent storage of the face information, and it is applicable to portraits for passport, driver license, and “mugshot” images.
- **Token Frontal:** A Face Image Type that specifies frontal images with a specific geometric size and eye positioning based on the width and height of the image. This image type is suitable for minimizing the storage requirements for computer face recognition tasks such as verification while still offering vendor independence and human verification (versus human examination which requires more detail) capabilities.

Table 1 shows the relationships between Face Image Types using the notion of inheritance. For example, Frontal inherits properties from Basic, which means that all normative clauses that apply to Basic also apply to Frontal.

Table 1 – Inheritance of Face Image Types

Face Image Type	Inherits from	Normative clauses	Informative clauses
Basic	None	1, 2, 3, 4, 5, 6	A.1
Frontal	Basic	7	A.2
Full Frontal	Frontal	8	A.3
Token	Frontal	9	A.4

Figure 1 gives a general overview of the scene, photographic, digitization, and format requirements for the face image types specified in this part of ISO/IEC 19794.

Requirements			
Scene	**Photographic**	**Digital**	**Format**
 Lighting	 Positioning	 Digital Camera	 Digital Specifications
 Image and Subject	 Camera Attributes	 Analogue to Digital	 Record Format and Organization
		 Image Scanning	
Clauses: Basic Face None Frontal Face 7.2 Full Frontal Face 8.2	*Clauses:* Basic Face None Frontal Face 7.3 Full Frontal Face 8.3	*Clauses:* Basic Face None Frontal Face 7.4 Full Frontal Face 8.4 Token Face 9.2	*Clauses:* Basic Face 5 6.2 6.3 6.4 Frontal Face Full Frontal Face 7.5 Token Face 8.5 9.3

Figure 1 – The types of imaging requirements specified in this part of ISO/IEC 19794. The Basic Face Image Type has no scene, photographic, or digitizal requirements

2 Compliance

Conformity with this part of ISO/IEC 19794 requires compliance with the record format specification defined in clauses 5 and the Basic Face Image Type defined in clause 6.

In addition, this part of ISO/IEC 19794 defines additional Face Image Types. Compliance with the Full Frontal Face Image Type requires compliance with clauses 5, 6, 7, 8. Conformity with the Token Frontal Image Type requires additional compliance with clause 5, 6, 7, 9.

3 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 10918 (all parts), *Information technology — Digital compression and coding of continuous-tone still images: Requirements and guidelines*

ISO/IEC 14496-2:2004, *Information technology — Coding of audio-visual objects — Part 2: Visual*

ISO/IEC 15444 (all parts), *Information technology — JPEG 2000 image coding system*

ISO/IEC 19785 (all parts), *Information technology — Common biometric exchange formats framework*

ISO/IEC 19794-1, *Information technology — Biometric data interchange formats — Part 1: Framework*

C-Cube Microsystems, JPEG File Interchange Format (JFIF), Version 1.02

PIMA 7667:2001, Photography — Electronic Still Picture Imaging — Extended sRGB Color Encoding — e-sRGB

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19794-1 and the following apply.

4.1
chin
the central forward portion of the lower jaw

4.2
colour image
continuous tone image that has more than one channel, each of which is coded with one or multiple bits

4.3
colour space
a way of representing colours of pixels in an image. For instance, RGB, YUV and greyscale are typically used in this document.

4.4
common biometric exchange formats framework
CBEFF
data format specifically for exchanging biometric data that provides for the encompassing of any biometric type into a standard format

4.5
continuous tone image
image whose channels have more than one bit per pixel

4.6
crown
top of the head, or (if obscured by hair or headwear), where the top of the head/skull would be if it could be seen

4.7
dots per inch
DPI
measurement of scanner and printer resolution

4.8
facial image
electronic image-based representation of the portrait of a person

4.9
Face Image Type
a category of facial images that satisfy specific requirements

4.10
FAP
Facial Animation Parameter

4.11
fish eye
a type of distortion where central objects of the image erroneously appear closer than those at the edge

4.12
greyscale image
continuous tone image that has only one luminance channel coded e.g. with 8 bit; also referred to as a monochrome or black and white image

4.13
human examination
process of careful human comparison of a face image with a person or another face image to ascertain the identity of the respective person by a detailed examination of facial features and structures

4.14
human verification
process of human comparison of a face image with a person or another face image to ascertain the identity of the respective person in a short time period; one-to-one (1:1) matching

4.15
identification
process of searching though a list of face images to match against an input image(s); one-to-many (1:N) searching

4.16
image
two-dimensional representation that encodes the luminance and texture of an object in a given lighting environment

4.17
JPEG
image compression standard specified as ISO/IEC 10918

NOTE The JPEG baseline standard was published as ISO/IEC 10918-1:1994 and ITU-T Rec. T.81.

4.18
JPEG2000
image compression standard specified as ISO/IEC 15444

NOTE The JPEG2000 baseline standard was published as ISO/IEC 15444-1:2000 and ITU-T Rec. T.800.

4.19
Feature Point
reference point(s) in a face image as used by face recognition algorithms, commonly referred to as a landmark

EXAMPLE Position of the eyes.

4.20
pixel
picture element; element on a two-dimensional array that comprises an image

4.21
portrait
photograph of a person which includes the full head, with all hair in most cases, as well as neck and top of shoulders

4.22
red-eye
the red glow from subject's eye caused by light from flash reflecting from blood vessels behind the retina

4.23
verification
process of ascertaining that two images or image inputs represent the same person; one-to-one (1:1) matching

5 The face record format

5.1 Overview

The face record format specified in this document is a format to store face image data within a biometric data record. Each record shall pertain to a single subject and shall contain one or more images of a human face. This record is embedded in the biometric data block in a CBEFF compliant structure. The record structure is depicted in Figure 2.

Adherence to this format requires compliance to the standards referred to above. In particular, the header and the entire data structure will be CBEFF compatible and the image data will be encoded using either JPEG or JPEG2000.

When referring to elements of the record format, "field" denotes the minimum element such as Face Image Type and Image Data Type, "block" denotes the group of fields such as Facial Information block or Image Information block, and "record" denotes the image data which consists of the Facial Record Header and one or more Facial Record Data.