

INTERNATIONAL STANDARD

ISO/IEC 19794-5

First edition
2005-06-15

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

Reference number
ISO/IEC 19794-5:2005(E)



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO/IEC 2005

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

Contents

	Page
Foreword	vi
Introduction	vii
1 Scope	1
2 Compliance.....	3
3 Normative references	3
4 Terms and definitions	3
5 The face record format	5
5.1 Overview	5
5.2 Data Conventions.....	7
5.2.1 Byte ordering.....	7
5.2.2 Numeric values.....	7
5.2.3 Conversion to integer	7
5.2.4 Unspecified field value	7
5.2.5 Unknown field value	7
5.3 The CBEFF Header.....	7
5.4 The Facial Record Header	8
5.4.1 Format Identifier.....	8
5.4.2 Version Number	8
5.4.3 Length of Record	8
5.4.4 Number of Facial Images.....	8
5.5 The Facial Information block.....	8
5.5.1 Facial Record Data Length	9
5.5.2 Number of Feature Points	9
5.5.3 Gender	9
5.5.4 Eye Colour	10
5.5.5 Hair Colour	10
5.5.6 Property Mask	12
5.5.7 Expression.....	13
5.5.8 Pose Angle	13
5.5.9 Pose Angle Uncertainty	15
5.6 The Feature Point Block	15
5.6.1 Feature Point Type.....	15
5.6.2 Feature Point Code	15
5.6.3 MPEG4 Feature Points.....	17
5.6.4 Eye and nostril centre Feature Points	18
5.7 The Image Information Block	19
5.7.1 Face Image Type	19
5.7.2 Image Data Type.....	20
5.7.3 Width.....	20
5.7.4 Height.....	20
5.7.5 Image Colour Space.....	20
5.7.6 Source Type	21
5.7.7 Device Type	21
5.7.8 Quality.....	22
5.8 The Image Data Block.....	22
5.8.1 Data structure.....	22
6 The Basic Face Image Type	22
6.1 Inheritance requirements for the Basic Face Image Type	22
6.2 Image data encoding requirements for the Basic Face Image Type	22

6.3	Image data compression requirements for the Basic Face Image Type.....	22
6.4	Format requirements for the Basic Face Image Type	22
6.4.1	Facial Header.....	22
6.4.2	Facial Information	22
6.4.3	Image Information.....	23
7	The Frontal Face Image Type.....	23
7.1	Inheritance requirements for the Frontal Face Image Type.....	23
7.2	Scene requirements for the Frontal Image Type	23
7.2.1	Purpose.....	23
7.2.2	Pose	23
7.2.3	Expression.....	23
7.2.4	Assistance in positioning the face	24
7.2.5	Shoulders	24
7.2.6	Backgrounds	24
7.2.7	Subject and scene lighting.....	24
7.2.8	Shadows over the face	24
7.2.9	Shadows in eye-sockets.....	24
7.2.10	Hot spots	24
7.2.11	Eye glasses	24
7.2.12	Eye patches	25
7.3	Photographic Requirements for the Frontal Image Type.....	25
7.3.1	Purpose.....	25
7.3.2	No over or under exposure	25
7.3.3	Focus and depth of field.....	25
7.3.4	Unnatural colour	25
7.3.5	Colour or greyscale enhancement.....	25
7.3.6	Radial distortion of the camera lens.....	25
7.4	Digital requirements for the Frontal Image Type.....	25
7.4.1	Geometry	26
7.4.2	Colour profile	26
7.4.3	Video interlacing	26
7.5	Format requirements for the Frontal Image Type.....	27
7.5.1	Inheritance requirements	27
7.5.2	Image Information	27
8	The Full Frontal Image Type.....	27
8.1	Inheritance requirements for the Full Frontal Face Image Type	27
8.2	Scene requirements for the Full Frontal Face Image Type	27
8.3	Photographic requirements for the Full Frontal Face Image Type.....	27
8.3.1	Introduction	27
8.3.2	Horizontally centred face.....	28
8.3.3	Vertical position of the face	28
8.3.4	Width of head	28
8.3.5	Length of head	29
8.3.6	Summary of photographic requirements	29
8.4	Digital requirements for the Full Frontal Face Image Type.....	29
8.4.1	Resolution	29
8.5	Format requirements for the Full Frontal Image Type	29
8.5.1	Inheritance requirements	29
8.5.2	Image Information	29
9	The Token Face Image Type	29
9.1	Inheritance requirements for Token Face Image Type.....	29
9.2	Digital requirements for the Token Face Image Type	30
9.2.1	Introduction	30
9.2.2	Eye positions.....	30
9.2.3	Token image geometric format	30
9.2.4	Minimum width Token image	31
9.2.5	Padding.....	31
9.3	Format requirements for the Token Face Image Type	31
9.3.1	Inheritance requirements	31
9.3.2	Image Information	31

Annex A (informative) Best practices for Face Images	32
A.1 Basic Face Images.....	32
A.1.1 Purpose.....	32
A.1.2 Feature Point determination.....	32
A.2 Frontal Images.....	32
A.2.1 Purpose.....	32
A.2.2 Expression.....	32
A.2.3 Assistance in positioning the face	33
A.2.4 Backgrounds	33
A.2.5 Focus and depth of field.....	33
A.2.6 No unnatural colour	34
A.2.7 Colour calibration	34
A.2.8 Radial distortion of the camera lens.....	34
A.3 Full Frontal Images	34
A.3.1 Digital attributes of Full Frontal Images.....	34
A.3.2 Best practices for use of Full Frontal Images on travel documents	34
A.3.3 Full Frontal Image Compression.....	39
A.3.4 Full Frontal Image compression using region of interest.....	41
A.4 Token Images	42
A.4.1 Token image sizes	42
A.4.2 Creation of a Token Image	43
A.4.3 Best practices for digital attributes of Token Images	43
A.4.4 Token Image compression	43
A.4.5 Token Image compression using region of interest.....	45
A.4.6 Inner and outer regions for the Token Image for the purpose of compression	45
Bibliography.....	47

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
<i>Clauses:</i> Basic Face None	<i>Clauses:</i> Basic Face None	<i>Clauses:</i> Basic Face None	<i>Clauses:</i> Basic Face 5 6.2 6.3 6.4
Frontal Face 7.2 Full Frontal Face 8.2	Frontal Face 7.3 Full Frontal Face 8.3	Frontal Face 7.4 Full Frontal Face 8.4 Token Face 9.2	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 digital 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*