INTERNATIONAL STANDARD

ISO/IEC
19794-10

Information technology — Biometric data interchange formats —

Part 10:
Hand geometry silhouette data

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

Partie 10: Données de la silhouette de la géométrie de la main

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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 19794-10 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*

— *Part 7: Signature/sign time series data*

— *Part 8: Finger pattern skeletal data*

— *Part 9: Vascular image data*

— *Part 10: Hand geometry silhouette data*

The following part is under preparation:

— *Part 11: Signature/sign processed dynamic data*

Introduction

In the Access Control and Time Management communities, hand geometry has been an option to add biometrics to traditional security systems. While several hand geometry systems have been developed into products, each vendor has traditionally relied on a proprietary algorithm and has stored a proprietary template. This has made it impossible to transfer data from one vendor's system to another's, forcing end users to sole-source their hand geometry solution. To allow integration of hand geometry systems from multiple vendors, a nonproprietary interchange format must be adopted.

This part of ISO/IEC 19794 is intended to provide a data interchange format (a CBEFF biometric data block – BDB) for applications requiring an interoperable hand geometry record. The information consists of a variety of mandatory and optional items including data capture parameters, standardized hand position and vendor-specific information. This information is intended for interchange among organizations that rely on automated devices and systems for identification or verification purposes based on the information from hand geometry. While this part of ISO/IEC 19794 mandates a particular data format, it does not mandate a particular algorithm. For example, a user may be enrolled on a system from one vendor and verified on a system from another.

Because hand geometry products have historically relied on measurements taken from a hand silhouette, this format stores hand silhouette data rather than color or grayscale image data. To increase the flexibility of the data format, provisions have been made to store views of the left and right hands, in addition to multiple views of each hand. Specific implementations of this part of ISO/IEC 19794 that are constrained by storage space (such as smart card applications) may wish to limit the number of views stored for each hand. Such limitations are outside the scope of this part of ISO/IEC 19794, but reduced choices can prejudice interoperability.

It is well known that the presentation of a biometric sample affects algorithm performance. While image acquisition and hand placement requirements are outside the scope of this part of ISO/IEC 19794, Annex B is provided as guidance for those wishing to adhere to industry "best practices".

Information technology — Biometric data interchange formats —

Part 10:
Hand geometry silhouette data

1   Scope

This part of ISO/IEC 19794 specifies a data interchange format (a CBEFF biometric data block – BDB) that can be used for storing, recording and transmitting the information obtained from a hand silhouette.

This part of ISO/IEC 19794 defines the content, format and units of measurement for the exchange of hand silhouette data in a BDB.

Information formatted in accordance with this part of ISO/IEC 19794 can be recorded on machine-readable media or transmitted by data communication between systems.

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2   Conformance

ISO/IEC 19794-10:2007
A biometric data block conforms to this part of ISO/IEC 19794 if it satisfies the format requirements specified
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within the normative clauses of this part of ISO/IEC 19794 and has internal consistency based on capture
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from an actual hand.

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 19785-1, *Information technology — Common Biometric Exchange Formats Framework — Part 1: Data element specification*

ISO/IEC 19784-1, *Information technology — Biometric application programming interface — BioAPI specification*

4   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
biometric data block
BDB
block of data with a defined format that contains one or more biometric samples or biometric templates

NOTE   In the case of this part of ISO/IEC 19794, the BDB contains the hand silhouette of one or both hands, perhaps with multiple views.

4.2
biometric sample
information obtained from a biometric device, either directly or after further processing

NOTE   The silhouette of a hand is an example of a biometric sample.

4.3
camera point of view
effective location and orientation of a camera that would result in the observed hand silhouette

NOTE   The effective location is specified rather than the actual location due to the possibility of algorithmic transformations and various hand-scanning technologies such as movable linear arrays, etc.

4.4
capture
process of taking a biometric sample from an end user

4.5
Freeman Chain Code
FCC
compact method for representing the contours of an object

NOTE   First made popular by Herbert Freeman.

4.6
image resolution
number of pixels per unit distance in the interchanged image

NOTE   This may be the result of processing a captured image. The original captured image may have been subsampled, scaled, interpolated or otherwise processed to produce a silhouette suitable for automated hand recognition.

4.7
live capture
process of capturing a biometric sample through an interaction between an end user and a biometric system

4.8
hand geometry view record
HGVR
block of data that contains a hand silhouette captured from one camera point of view during one hand placement

NOTE   The block contains metadata, silhouette data and optional extended data.

4.9
pixel
picture element located on an n by m matrix of picture elements, where n is the horizontal component and m is the vertical component

4.10
platen
reference surface on which a hand is placed during imaging

NOTE   The platen will often contain alignment pins to promote repeatable finger placement.

4.11
side-view
data taken from the thumb side or the little-finger side of the hand

cf. **top-view**

4.12
side-view reference plane
physical or imaginary plane on which the side-view silhouette is projected

4.13
tip
⟨finger⟩ end of the fingernail or the end of the flesh at the end of the finger, whichever produces the longer silhouette

NOTE   See Figure 3 a).

4.14
top-view
data taken from the palm side of the hand or the back side of the hand

cf. **side-view**

4.15
web
area connecting two adjacent fingers at their connection point to the palm

NOTE   See Figure 3 a).

5   General

5.1   Byte order

For the purposes of transfer and storage of the BDB, the more significant bytes of any multi-byte quantity are present before less significant bytes.

NOTE   This is commonly referred to as a "big-endian" encoding, or "network byte" order.

Within a byte, the bits are numbered from 0 to 7, where 7 is the "most significant bit" (MSB) and bit 0 the "least significant bit" (LSB).

## 5.2   Use of FCCs for data compression

To conserve space, the hand silhouette shall be recorded using a Freeman Chain Code (FCC).

NOTE   This representation requires only 2-3 bits per pixel along the perimeter of the silhouette. The FCC has long been used to represent black-and-white contours.
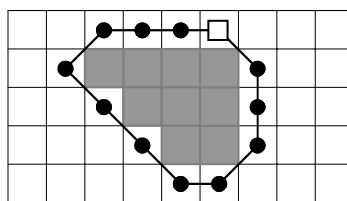
Each element of the FCC shall be stored immediately following its predecessor, without regard to byte boundaries. If necessary, the silhouette shall be padded with trailing zeros to ensure that the BDB is an integral number of octets.

Two forms of FCC are supported by this part of ISO/IEC 19794. The 8-way FCC uses three bits per pixel to represent the direction from one pixel to an adjacent pixel. The 4-way FCC uses two bits per pixel by eliminating the diagonal directions allowed in the 8-way FCC.

Silhouette data contained in BDBs conforming to this part of ISO/IEC 19794 (see clause 2) shall be body-centric and not grid centric FCCs as shown in Figure 1 (starting/ending points are shown as squares, intermediate points as circles).
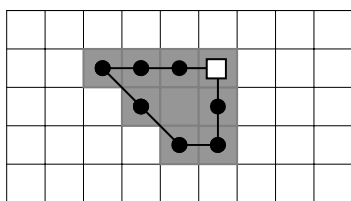
a) Body-centric 8-way FCC = 4,4,4,7,7,0,2,2   b) Grid-centric 8-way FCC = 4,4,4,5,7,7,7,0,1,2,2,3

Figure 1 — Body-centric and grid-centric Freeman Chain Code

5.3 CBEFF Format owner and format type

The BDB format specified in this part of ISO/IEC 19794 shall be embedded in a CBEFF-compliant Biometric Information Record (BIR) according to ISO/IEC 19785-1. The structure of a hand geometry silhouette BIR is depicted in Figure 2, where the CBEFF Standard Biometric Header (SBH) is mandatory, and the CBEFF Security Block (SB) is optional.

Figure 2 — Overview of a hand geometry silhouette biometric information record

NOTE   The CBEFF signature holds data that enables the integrity and/or the originator of the hand geometry silhouette BIR to be verified [electronic signature or message authentication code (MAC)].

The CBEFF Format Owner identifier assigned by the CBEFF Registration Authority to ISO/IEC JTC 1/SC 37 shall be used in the CBEFF SBH associated with the BDB. This is the sixteen-bit value 0x0101 (hexadecimal 101 or decimal 257).

There is one CBEFF Format Type code assigned to the data record specified in this part of 19794. This code shall be included in the CBEFF SBH. The sixteen-bit value 0x0018 (hexadecimal 18 or decimal 24) shall be used for data records specified in this part of 19794.
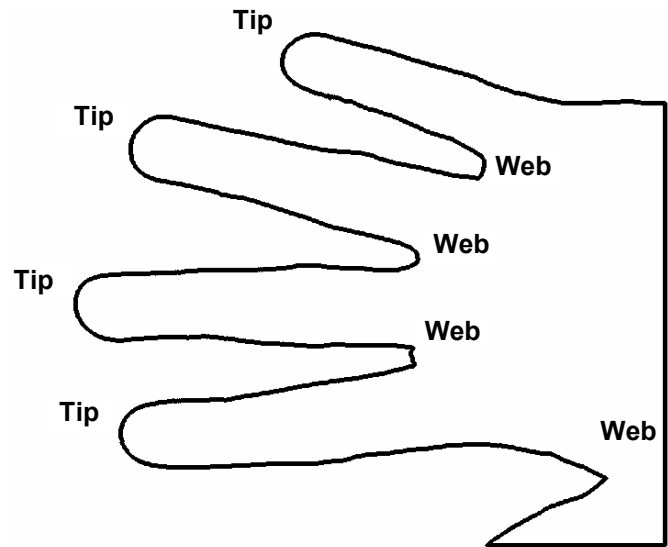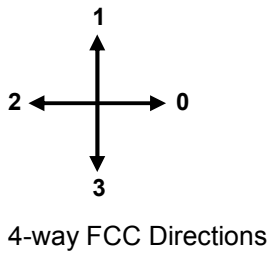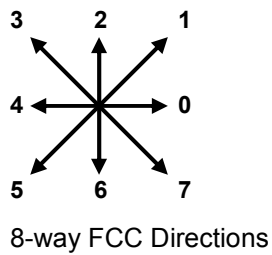
6 Silhouette acquisition requirements

6.1 Overview

It is not the purpose of this part of ISO/IEC 19794 to specify the method of data capture or the order of process steps used to capture the silhouette. However, after data acquisition and processing, each silhouette shall have the orientation shown in Figure 3 a) for top-view images, or Figure 3 b) for side-view images.

6.2 Hand orientation

The silhouette shall represent either the left or right hand and shall be presented in one of the orientations depicted in Figures 3 a) and 3 b).

NOTE   Silhouettes taken from a left hand pinned platen shall be flipped (mirror image) to match the form of Figure 3a).
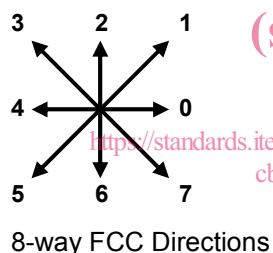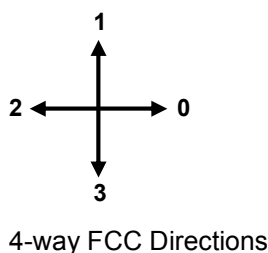
3   2   1

4   0

5   6   7

8-way FCC Directions

1

2   0

3

4-way FCC Directions

Tip

Tip

Tip

Tip

Web

Web

Web

Web

a)   Top-view images

3   2   1

4   0

5   6   7

8-way FCC Directions

1

2   0

3

4-way FCC Directions

b)   Side-view images

Figure 3 — Standard hand orientation for images

6.3   Aspect ratio

The aspect ratio shall be 1:1, within a tolerance of $\pm\,2\%$.

NOTE 1   The following example may be useful in calculating the aspect ratio: Assume a grid with 25 mm spacing is placed at the camera centerline, with the grid normal to the centerline axis. The aspect ratio of a captured image may be calculated by counting the number of pixels between the grid lines $\pm\,25$ mm from the origin. A system that counts 100 pixels in the x direction and 108 pixels in the y direction has an 8% error compared to the ideal 1:1 aspect ratio.

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