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Information technology — Biometric data interchange formats —

Part 11: Signature/sign processed dynamic data

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

Partie 11: Données dynamiques traitées de signature/signe

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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

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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 19794-11 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*

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

— *Part 13: Voice data*

— *Part 14: DNA data*

Introduction

There are several commercial implementations of signature/sign verification based on the analysis of the dynamic features of signing. This part of ISO/IEC 19794 specifies an interchange format using signature/sign dynamic features that can be used to provide signature/sign verification. This data format enables interoperability without compromising any developers' Intellectual Property Rights.

A group of features are identified that are mandatory across all compliant implementations in order to ensure interoperability but the biometric interchange record format also supports proprietary data. The use of proprietary data is regulated in a similar manner to that used in ISO/IEC 19794-7, ensuring that comparable performance is achieved between the mandatory and proprietary features.

The features recorded represent significant dynamic events during the signing process, and thus represent an intelligent compression of the ISO/IEC 19794-7 format. From these other features can be calculated or estimated. Furthermore, using the significant events 19794-7 format can be extrapolated, and therefore other signature/sign feature data can be calculated or estimated.

The biometric interchange record format is a sequence of signature/sign representations, preceded by a general header that is common to all representations. Each signature/sign representation is recorded as a representation header followed by a sequence of Dynamic-event data for each signature/sign dynamic event.

In addition to the Dynamic-event data recorded for each signature/sign dynamic event, additional data is recorded representing overall features of the signature/sign representation. It should be noted that all recorded data for the signature/sign representation is recorded before any transformations are applied (e.g. rotation or time warping). The data recorded is either raw data or derived from the raw data.

This part of ISO/IEC 19794 does not specify the analysis to be undertaken by any particular comparison algorithms. The signature/sign features recorded in the data format can be used for analysis by many different comparison algorithms.

The format described is based on features (segmentation based on dynamic events) instead of sample points as described in ISO/IEC 19794-7.

The format defined in this part of ISO/IEC 19794 has the version number 1.0.

Annex A is normative and is intended to specify elements of conformance testing methodology, test assertions, and and test procedures ass applicable to this part of ISO/IEC 19794.

Annex B is informative and formally specifies the biometric interchange record format using the ASN.1 (see ISO/IEC 8824) notation and the ASN.1 Packed Encoding Rules (see ISO/IEC 8825-2), enabling the use of ASN.1 tools to assist implementation.

Annex C is informative. It gives guidance on the suitability of signature/sign for secure comparison purposes using the features recorded in the biometric interchange record format defined in this part of ISO/IEC 19794. Annex C identifies three indicators of signature/sign suitability: quantity of data, complexity of signature/sign, and consistency of signature/sign. Annex C suggests measurements that can be made in accessing these indicators, but does not quantify suitable measurements or provide any structure for recording the indicators.

Information technology — Biometric data interchange formats —

Part 11: Signature/sign processed dynamic data

1 Scope

For the purpose of biometric comparison, this part of ISO/IEC 19794 specifies a data interchange format for processed signature/sign behavioural data extracted from a time series, captured using devices such as digitizing tablets, pen-based computing devices, or advanced pen systems.

The data interchange format is generic, in that it may be applied and used in a wide range of application areas where handwritten signs or signature/signs are involved. No application-specific requirements or features are addressed in this part of ISO/IEC 19794.

This part of ISO/IEC 19794 contains definitions of relevant terms, a description of what data is extracted, and a data format for containing the data, together with advice on whether a set of user's signature/sign is suitable for identification purposes using this part of ISO/IEC 19794.

It is advisable that stored and transmitted biometric data is time-stamped and that cryptographic techniques be used to protect their authenticity, integrity, and confidentiality; however, such provisions are beyond the scope of this part of ISO/IEC 19794.

2 Conformance

A biometric data record conforms to this part of ISO/IEC 19794 if it satisfies all of the normative requirements related to:

A) Its data structure, data values and the relationships between its data elements, as specified in Clause 8 of this part of ISO/IEC 19794.

B) The relationship between its data values and the input biometric data from which the biometric data record was generated, as specified in Clause 8 of this part of ISO/IEC 19794.

A system that produces biometric data records is conformant to this part of ISO/IEC 19794 if all biometric data records that it outputs conform to this part of ISO/IEC 19794 (as defined above). A system does not need to be capable of producing biometric data records that cover all possible aspects of this part of ISO/IEC 19794, but only those that are claimed to be supported by the system.

A system that uses biometric data records is conformant to this part of ISO/IEC 19794 if it can read, and use for the purpose intended by that system, all biometric data records that conform to this part of ISO/IEC 19794 (as defined above). A system does not need to be capable of using biometric data records that cover all possible aspects of this part of ISO/IEC 19794, but only those that are claimed to be supported by the system.

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 19785-2, *Information technology — Common Biometric Exchange Formats Framework — Part 2: Procedures for the operation of the Biometric Registration Authority*

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

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
dynamic event
either a **pen-up**, **pen-down**, or **turning point** event

4.2
pen-down
event from which on the pen tip is touching the writing plane

4.3
dynamic-event data
data that records pen position, pressure and time for a given signature/sign **dynamic event**

4.4
pen-up
event from which on the pen tip is not touching the writing plane, after a **pen-down** event

4.5
signature/sign representation
data recorded from a single signature/sign

NOTE A **signature/sign representation** always starts with a **pen-down** event and ends with a **pen-up** event, but there can be more **pen-up** and **pen-down** events within the **signature/sign representation**.

4.6
turning point
event from which the sign of the inclination derived from adjacent samples of either X, Y or F channel changes

5 Conventions

5.1 Coordinate system

The coordinate system used to express the pen position shall be a two-dimensional Cartesian coordinate system. The x-axis shall be the horizontal axis of the writing plane, with the x coordinates increasing to the right starting at 0. The y-axis shall be the vertical axis of the writing plane, with y coordinates increasing upwards starting at 0.

5.2 Byte order

The more significant bytes of any multi-byte quantity are stored at lower addresses in memory than (and are transmitted before) less significant bytes.

Within a byte, the bits are numbered from 8 to 1, where bit 8 is the 'most significant bit' (MSB) and bit 1 the 'least significant bit' (LSB).

5.3 Registered format type identifier

The data records specified in this part of ISO/IEC 19794 may be embedded in a CBEFF- (ISO/IEC 19785-1) compliant biometric information record (BIR). This clause lists the BDB (biometric data block) format owner identifier and the BDB format type identifier that shall be used if embedded in a CBEFF BIR. This identifier is registered with IBIA, the CBEFF Registration Authority (see ISO/IEC 19785-2).

The format owner of the formats defined in ISO/IEC 19794 is ISO/IEC JTC 1/SC 37. The format owner identifier is 257 (0101Hex). Table 1 lists the format type identifier for the format defined in this part of ISO/IEC 19794.

Table 1 — Format type identifiers

CBEFF BDB format type identifier	Short name	Full object identifier
16 (0010_{Hex})	signature-sign-processed-dynamic	{iso(1) registration-authority(1) cbeff(19785) biometric-organization(0) jtc1-sc37(257) bdbs(0) signature-sign-processed-dynamic(16)}

6 Data format relationships

The processed data format described in this part of ISO/IEC 19794 may not be the final format used by dynamic signature/sign analysis algorithms for signature/sign feature analysis. The format is a segmentation based signature data format with sufficient information to derive signature/sign features for a variety of algorithms. Its use is shown in the flowchart in Figure 1.

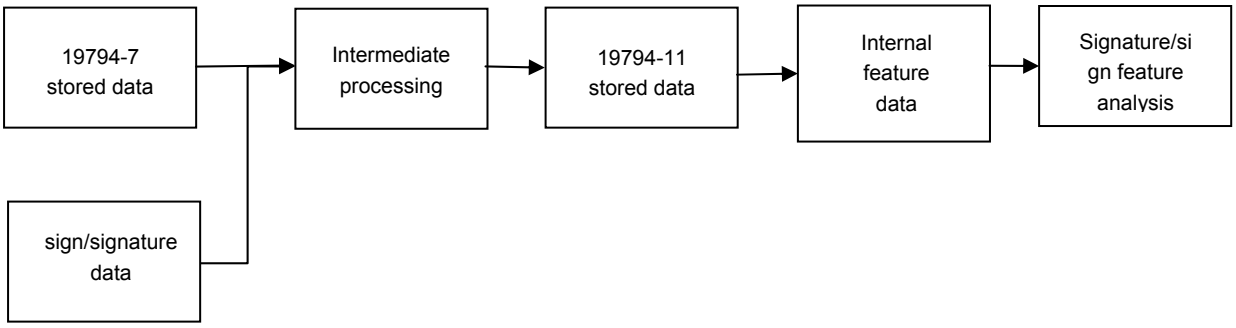

Figure 1 — Data format flowchart

7 Recorded Signature/sign data

7.1 Overview

By recording dynamic-event data at significant signature/sign dynamic events of: Pen-down, Pen-up, and Turning point, these can be combined into larger segments and/or extrapolated into the whole signing sequence for any feature analysis to be applied.

Signature/sign data will be recorded as a sequence of Dynamic-event data for each significant dynamic event, followed by an overall feature data set.

7.2 Dynamic-event data

Whenever a dynamic signature event occurs:

a) Pen-down

b) Pen-up

c) Turning point

The X, Y coordinates, pressure F, time T, and type of event shall be recorded.

7.2.1 Pen-down

Pen-down is an event from which the pen tip is touching on the writing plane. Pen-down is detected when the following change of F channel occurs.

$F_{n-1} = 0$ and $F_n > 0$

7.2.2 Pen-up

Pen-up is an event from which the pen tip is leaving from the writing plane. Pen-up is detected when the following change of F channel occurs.

$F_{n-1} > 0$ and $F_n = 0$

7.2.3 Turning point

A turning point is an event in which the sign of the inclination derived from adjacent samples of either X, Y or F channel changes, where Q denotes either X or Y of F channel. Two types of turning points are defined as follows,

Type-1: Changing from positive to zero or negative, in this type the turning point of Q channel shall satisfy the following conditions,

$$sign(Q_{n-1} - Q_{n-2}) = sign(Q_n - Q_{n-1}) = positive, \quad and$$
$$sign(Q_{n+2} - Q_{n+1}) = sign(Q_{n+1} - Q_n) = zero \quad or \quad negative$$

or

$$sign(Q_{n-1} - Q_{n-2}) = sign(Q_n - Q_{n-1}) = zero, \quad and$$
$$sign(Q_{n+2} - Q_{n+1}) = sign(Q_{n+1} - Q_n) = negative$$

where Q_n is the turning point of Q channel.

Type-2: Changing from negative to zero or positive, in this type the turning point of Q channel shall satisfy the following conditions,

$$sign(Q_{n-1} - Q_{n-2}) = sign(Q_n - Q_{n-1}) = negative, \quad and$$
$$sign(Q_{n+2} - Q_{n+1}) = sign(Q_{n+1} - Q_n) = zero \quad or \quad positive$$

or

$$sign(Q_{n-1} - Q_{n-2}) = sign(Q_n - Q_{n-1}) = zero, \quad and$$
$$sign(Q_{n+2} - Q_{n+1}) = sign(Q_{n+1} - Q_n) = positive$$

where Q_n is the turning point of Q channel.

Before calculating the sign of the inclination derived from adjacent samples, X, Y and F channels should be smoothed using a moving average filter of M points as follows (M shall be an odd number),

$$Q_i = \frac{1}{M} \sum_{m=-\frac{M-1}{2}}^{\frac{M-1}{2}} Q_{i+m}$$

,where Q_i is the i-th sample of Q channel.

The unit of measurement of X and Y is millimetres (mm) and the unit of measurement of F is Newtons (N), and the unit of measurement of T is milliseconds (ms). To restore the actual values, the integer values given in the BDIR body are to be divided by a scaling value given in the Representation Header. By choosing appropriate scaling values, different resolutions can be expressed for several applications.

7.3 Overall features Data

Other parameters that need to be recorded for overall signature/sign dynamic analysis are:

a) Total time

Total time T is defined as the time difference between the first recorded time to the last recorded time of a signature/sign.

The unit of measurement is milliseconds (ms).

To restore the actual value, the integer value given in the Total Time field is to be divided by a T Scaling Value given in the Representation Header.

b) Total number of points aquired TNP (this is a function of time and the sampling time capacities of the digitiser)

The total number of points measured is defined as the total number of coordinates recorded for a signature/sign as an integer.

c) Mean values

X_{mean} – Mean value of X values

Y_{mean} – Mean value of Y values

F_{mean} – Mean value of pressure (F) values

X_{mean}, Y_{mean} and F_{mean} are the arithmetic mean of the X, Y, and F values while the pen is in contact with the digitizer.

The unit of measurement for X_{mean}, and Y_{mean} is millimetres (mm). The unit of measurement of F_{mean} is Newtons (N).

To restore the actual value, the integer value given in the X and Y Mean Values field are to be divided by respectively by X and Y Scaling Value given in the Representation Header.