TECHNICAL SPECIFICATION

ISO/IEC TS 20027

First edition
2015-09-15

Biometrics interoperability profiles — Best practices for slap tenprint captures

Profils biométriques interopérables — Recommandations pour les captures de 10 doigts à plat

Reference number
ISO/IEC TS 20027:2015(E)

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

It has been adopted from the European Technical Specification, CEN/TS 16428:2012, *Biometrics Interoperability profiles — Best Practices for slap tenprint captures*.

Biometrics interoperability profiles — Best practices for slap tenprint captures

1 Scope

The main goal of this Technical Specification is to give guidelines to follow during the acquisition process of slap tenprints in order to obtain fingerprints with the best quality possible within acceptable time constraints.

Non-cooperative users are out of the scope of this Technical Specification.

When using ten-fingerprint sensors, it is fundamental to know how to use them and how to proceed during the acquisition. This Technical Specification describes how to capture fingerprints correctly by specifying best practices for slap tenprint captures.

It gives guidance on the following topics:

1) recommendations on the hardware of the fingerprint sensor and its deployment;
2) recommendations on user guidance;
3) recommendations on the enrolment process including a sample workflow;
4) recommendations for developers and system integrators on application software;
5) recommendations on processing, compression and coding of the acquired fingerprint images;
6) recommendations on operational issues and data logging;
7) recommendations on the evaluation of a solution and its components.

Although this Technical Specification primarily focuses on reaching optimal data quality for enrolment purposes, the recommendations given here are applicable for other purposes. All processes which rely on good quality tenprint slaps can take advantage of the best practices reported here.

2 Sensor hardware requirement

Image quality should comply with the quality specifications from ISO/IEC 19794-4 [1]. EBTS V 8.002:2008 [6], Annex F, corresponds to ISO/IEC 19794-4:2011, B.1, and BSI TR-03121 [5] corresponds to ISO/IEC 19794-4:2011, B.3.

NOTE 1 This Technical Specification considers optical sensors based on the principle of total internal reflection. However, this does not mean that other technologies cannot be used for tenprint enrolment purposes. As soon as sufficient experiences are available and recommendations can be given on emerging technologies, they will be included in a future version of this document.

The sensor device should provide methods for re-calibration in the field by qualified service staff if the device technically supports it.

It is recommended that the compliance of a sensor device to the applicable quality standard can be verified at any time in the operational environment.

NOTE 2 The need for calibration or re-calibration depends on the sensor technology and calibration might not be necessary for all devices.

3 Acquisition software

3.1 Acquisition process

For the acquisition process, the highest quality images should be used. The acquisition of these images should be done automatically. The sequence of images having the highest quality should be used; if a timeout has occurred then these may be below the desired quality levels.

An example for an acquisition process design can be found in Annex A and Annex B, an example for a quality metric can be found in Annex C.

3.2 User feedback

The presence of a user interface is strongly advised to give feedback to the user.

Feedback can be given, for example, by

— a screen attached in close neighbourhood to the sensor,

— illuminated pictograms on the sensor,

— LEDs assigned to pictograms directly on the sensor.

The following information should be given to the user:

— assistance to finger positioning with images and/or video on the screen and/or audio instructions (for instance to instruct the user to move its fingers to the left/right/top/bottom);

— visual and/or audio notification when a successful acquisition has been completed;

— a quality indicator for each acquisition, which indicator should be simple [e.g. a two-state logic (not good/good) or similar];

— if possible, the reason for a bad quality acquisition (e.g. wrong positioning of the hand).

Additional information (e.g. a poster or a video) can be used to illustrate to users how to use the system. This information can be displayed close to the sensor and additionally in the waiting zone.

Operators should be trained to give guidance to the users.

3.3 Acquisition check

The software linked to the sensor should take account of the following during the acquisition process in order to perform a better acquisition.

— Any feedback provided by the sensor software (background correction, quality evaluation, end of acquisition, etc.).

— A timeout for capturing the best available image in case the specified quality threshold is not reached.

— The inability of the subject to provide a full set of fingerprints. Acceptable images for certain fingers may not have been captured, which could be due to

  — missing fingers,

  — inability for the subject to interact with the sensor correctly,

  — temporary or permanent issues with the subject's fingerprints.

— The image quality of the captured images. This is to enable the system to finish the acquisition process after the preset quality level or a timeout has been reached.

— The subject's fingers have been removed from the sensor at the end of the acquisition process.

— All two consecutively captured slaps and captured thumbs are not identical. A duplicate check should also be performed to ensure that all expected fingers have been captured once and once only.

NOTE Due to computational time constraints this recommendation could also be enforced by the operator instead of the software.

— Residual traces have not been acquired.

— The fingerprint images are as originally acquired. Optionally, segmented images can be produced.

— Hand inversion between left and right slap has not occurred. This check can be based on the different physical characteristics of the shapes of both hands.

3.4 Image processing

3.4.1 Segmentation

Independently of physical resolution of the sensor and the image acquired, the resolution of the fingerprint image should be at least 197 ppcm (500 ppi) and, therefore, can differ from the scan resolution.

Depending on the call to capture one, two, three or four fingerprints, this number of individual fingerprints should be extracted from the input image and provided as single fingerprints generated by a segmentation process which takes into account fingers reported to be missed.

For this segmentation process, the following criteria should be fulfilled:

— Ability to accept rotated fingerprints having the same direction in an angle up to 45°

— Rotated fingerprints having the same direction should be corrected to be vertical

— Segment the first part over the finger (first phalanx)

— Segmentation should be performed on uncompressed data.

Recommended size for fingerprint images is given in ISO/IEC 19794-4:2011, D.1.

NOTE Size limitation is done in order to prevent performance issues.

3.4.2 Compression

Fingerprint images should be compressed according to the recommendations in ISO/IEC 19794-4:2011, section 8.3.17, "Image compression algorithm".

NOTE 1 The compression ratio should not be too high, a maximum compression ratio of 15 is recommended.

NOTE 2 The WSQ compression is mainly used for fingerprint compression; it has been optimized to be compatible with minutiae calculation.

The implementation of the used WSQ algorithm should be certified by the FBI and should be referenced by the respective certificate number (coded in the WSQ header).

Multiple lossy compressions should be avoided as they harm image quality.

4 Logging and evaluation of data

4.1 General

Logging and evaluation data might be subject to national legal constraints and should be handled accordingly.

4.2 Logging data

The purpose of the logging data is not to track people but to give guidance to the staff in charge of the enrolment and to maintain a constant quality of the acquisition process.

The following data, or parts of it, should be logged.

— transaction ID;

— timestamp of acquisition;

— duration of biometric acquisition process;

— number of captured images;

— number of successful captures;

— quality scores for all captured fingerprints;

— overall quality score of captured slap or tenprints sets (if present);

— information about vendor, software, hardware and versions;

— information about the origin (e.g. Agency Identifier);

— information about errors (e.g. about uniqueness check, segmentation, etc.)

— size of acquired data;

— testing flags (if applicable);

— demographic data on the subject (gender, age).

NOTE It might be appropriate to have a regular logging workflow and an evaluation mode logging workflow with more comprehensive logging data. The latter one could be used for regular or incident-based checks of the whole process.

When used in a verification or identification scenario, it is recommended to also log results of the verification and identification process.

4.3 Useful statistical evaluations

Conducting regular (e.g. every month, every three month, every year) evaluations on the acquired logging data is recommended.

As a minimum, the following basic set of evaluations should be conducted:

— quality scores distribution;

— error code distribution;

— average enrolment duration;

— distribution of enrolment duration;

— distribution of gender and age, especially in relation to quality scores.

When used in a verification or identification scenario, it is recommended to also evaluate the accumulated results of the verification or identification attempts.

5 Operational process

5.1 General user guidance

The presence of a user interface is strongly advised to support better acquisition.

The following placement recommendations should be applied.

— The user should set down the fingers flat on the sensor and in particular their tips but not set down only the tips [(see Figure 1) a)] or the sides of the fingers (see Figure 1) b)].

a) Tips of the fingers **b) Sides of the fingers**

Figure 1 — Finger positions on sensor

— The user should position his or her fingers straight, parallel to the edges of the sensor [see Figure 2 b)] and avoid any rotation unless a rotation is the only way to place all fingers on the acquisition surface of the sensor (see Figure 2 b)].

a) Prefer parallel fingers in relation to the edges **b) Avoid rotated fingers in relation to the edges**

Figure 2 — Finger positions (cont.)

— The user should position the thumb(s) straight, parallel to the edges of the sensor (see Figure 3) and avoid any rotation.

a) Correct thumb position

b) Wrong thumb position

Figure 3 — Thumb positions

— The user should put down all the fingers simultaneously on the sensor (do not roll them on the sensor or do not put down one finger after the other on the sensor).

— The user should not spread fingers too much [see Figure 4 a)] or cross his/her fingers [see Figure 4) b)].

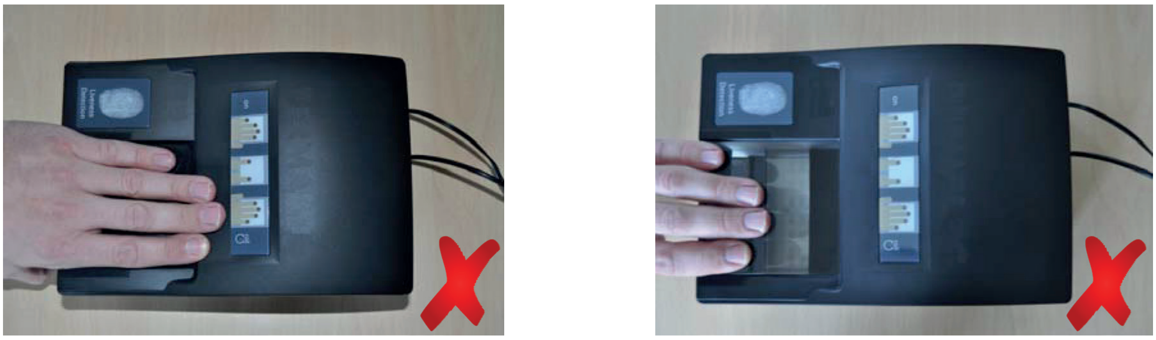
a) Spread fingers

b) Crossed fingers

Figure 4 — Spreading and crossing fingers

— The user should centre the hand or the thumb(s) on the sensor acquisition surface.

— The user should not position his/her fingers on the borders of the sensor acquisition surface, in order to avoid cutting or missing part of the slap (see Figure 5).



a) Mind the *top* border of the sensor **b) Mind the *low* border of the sensor**

Figure 5 — Minding sensor borders

— The user should position the fingers on the sensor such that as much as possible of the fingers is placed on the scanning area. If the user has placed the hand on the sensor wrongly, it should be ensured that the hand is removed before putting it down again on the sensor, as moving the hand directly on the sensor could cause distortions.

5.2 Acquisition process recommendations

Visual instructions should be provided to the user to understand how to position the fingers on the sensor correctly. It is recommended to instruct the user to look at these instructions carefully, listen to the advice given by the operator in a supervised context and to follow the instructions of the sensor (led, beeps, etc.) after each step of the process.

NOTE 1 Samples of pictograms, icons and symbols are currently developed in ISO/IEC 24779-4.[7]

NOTE 2 A study conducted by the USA's National Institute of Standards and Technology (NIST) shows that best results are obtained by combining audio and video rather than by using written instructions only.[2]

— The user should move in front of the sensor and place the indicated finger(s) with great ease on the prism surface.

— The user should wipe his/her fingers if they are wet [see Figure 6 a) and b)] or moisten them if they are too dry [Figure 6) c)].

a) Example of a wet finger **b) Example of a correct-quality finger** **c) Example of a too-dry finger**

Figure 6 — Quality of fingers

