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<th>Standards and/ or Project</th>
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<td><strong>ISO/IEC 19784-1:2006</strong></td>
<td>ISO/IEC 19784-1:2006 provides a defined interface that allows a software application to communicate with (utilize the services of) one or more biometric technologies. It includes a high-level generic biometric authentication model suited to a broad range of biometrically enabled applications and to most forms of biometric technology. An architectural model is described which enables components of a biometric system to be provided by different vendors, and to interwork through fully-defined Application Programming Interfaces (APIs), corresponding Service Provider Interfaces (SPIs), and associated data structures. ISO/IEC 19784-1:2006 covers the basic biometric functions of enrollment, verification and identification, and includes a database interface to allow an application to manage the storage of biometric records. Conformance requirements are identified and informative annexes, including sample code, are provided. ISO/IEC 19784-1:2006 specifies a biometric data structure which is compatible with ISO/IEC 19785 and 19794.</td>
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<td><strong>ISO/IEC 19784-1:2006/Amd 1:2007</strong></td>
<td>BioGUI specification</td>
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<td><strong>ISO/IEC 19784-2:2007</strong></td>
<td>ISO/IEC 19784-2:2007 defines the interface between a biometric service provider (BSP) and a biometric archive function provider (BAFP) for BioAPI. A BAFP encapsulates all functionality for the storage, search and management of biometric reference data regardless of the kind of physical storage media. Using a BAFP, a BSP does not have to provide special handling of different storage media like database servers, smartcards, database web services, etc. Whatever media is used, the BSP in all cases handles the same interface for a BAFP. The interface description contains management functions to attach and detach different BAFPs, to query biometric data records and to store biometric data records.</td>
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<td><strong>ISO/IEC 19785-1:2006</strong></td>
<td>ISO/IEC 19785-1:2006 defines a basic structure for standardized biometric information records (BIRs) within the Common Biometric Exchange Formats Framework (CBEFF). This structure consists of three parts: the standard biometric header (SBH), the biometric data block (BDB), and the security block (SB). CBEFF also defines several data elements and their standardized abstract values that can be used in SBHs and SBs (CBEFF treats the BDB as opaque data). CBEFF also establishes mechanisms by which organizations, called 'patrons' by CBEFF, can specify and publish BIR format specifications, which are in turn called 'patron formats'.</td>
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CBEFF enables patrons to develop BIR specifications that are fully standardized and interoperable, yet are specifically adapted to the requirements of a particular application environment.

CBEFF defines rules for BIRs that contain only one BDB (simple BIR) and that contain at least one BDB (complex BIR). CBEFF defines mandatory data elements that identify the format of a BDB and its security attributes (encryption and integrity). All the other CBEFF-defined data elements and abstract values are optional. CBEFF enables patrons to define additional data elements and abstract values as required by the application environment.

ISO/IEC 19785-2:2006 specifies the requirements for the operation of the Biometric Registration Authority within the Common Biometric Exchange Formats Framework (CBEFF). The Registration Authority is responsible for assigning and publishing, via its website, unique biometric organization identifier values to organizations that own or are otherwise responsible for standardized or proprietary format specifications for biometric data blocks, biometric information record security blocks and/or CBEFF patron formats, and to organizations that intend to assign biometric product identifier values to their products.

ISO/IEC 19785-3:2007 specifies several patron formats that conform to the requirements of ISO/IEC 19785-1. ISO/IEC 19785-1 defines a basic structure for standardized biometric information records (BIRs) that consists of three parts, the standard biometric header (SBH), the biometric data block (BDB), and the security block (SB). CBEFF also defines several data elements and their standardized abstract values that can be used in SBHs and SBS (CBEFF treats the BDB as opaque data). CBEFF also establishes mechanisms by which organizations, called “patrons” by CBEFF, can specify and publish BIR format specifications, which are in turn called “patron formats”. CBEFF enables patrons to develop BIR specifications that are fully standardized and interoperable, yet are specifically adapted to the requirements of a particular application environment.

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Standardized biometric data interchange formats are crucial to the interoperability of biometric components. ISO/IEC 19794-1:2006 describes general aspects of biometric data interchange formats and specifies requirements to be taken into account in standardizing specific formats. It classifies biometric data according to their processing level and establishes a naming concept for biometric data interchange formats on this basis.

ISO/IEC 19794-2:2005 specifies a concept and data formats for representation of fingerprints using the fundamental notion of minutiae. It is generic, in that it may be applied and used in a wide range of application areas where automated fingerprint recognition is involved. ISO/IEC 19794-2:2005 contains definitions of relevant terms, a description of how minutiae shall be determined, data formats for containing the data for both general use and for use with cards, and conformance information. Guidelines and values for matching and decision parameters are provided in an informative annex.

ISO/IEC 19794-2:2005 specifies

- the fundamental data elements used for minutiae-based representation of a fingerprint;
- three data formats for interchange and storage of this data: a record-based format, and normal and compact formats for use on a smart card in a match-on-card application;
- optional extended data formats for including additional data such as ridge counts and core and delta location.


ISO/IEC 19794-3:2006, the finger pattern spectral data interchange format, specifies requirements for the representation of local or global spectral data derived from a fingerprint image. The format is designed to provide flexibility in the choice of spectral representation in that spectral components may be based on quantized co-sinusoidal triplets, Discrete Fourier Transformations or Gabor filters. The format also allows for a variable number of spectral components to be retained, which enables data representations in a form that is more compact than storage of the entire fingerprint image. ISO/IEC 19794-3:2006 provides example data records for each of the spectral representations.
ISO/IEC 19794-4:2005 specifies a data record interchange format for storing, recording, and transmitting the information from one or more finger or palm image areas within an ISO/IEC 19785-1 CBEFF data structure. This can be used for the exchange and comparison of finger image data. It defines the content, format, and units of measurement for the exchange of finger image data that may be used in the verification or identification process of a subject. The information consists of a variety of mandatory and optional items, including scanning parameters, compressed or uncompressed images 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 finger image areas. Information compiled and formatted in accordance with ISO/IEC 19794-4:2005 can be recorded on machine-readable media or may be transmitted by data communication facilities.

ISO/IEC 19794-5:2005 specifies scene, photographic, digitization and format requirements for images of faces to be used in the context of both human verification and computer automated recognition. The approach to specifying scene and photographic requirements in this format is to carefully describe constraints on how a photograph should appear rather than to dictate how the photograph should be taken. The format is designed to allow for the specification of visible information discernable by an observer pertaining to the face, such as gender, pose and eye colour. The digital image format can be either ISO standard JPEG or JPEG2000. Finally, the 'best practice' appendices provide guidance on photo capture for travel documents and face recognition performance versus digital compression.

ISO/IEC 19794-6:2005 specifies two alternative image interchange formats for biometric authentication systems that utilize iris recognition.

The first is based on a rectilinear image storage format that may be a raw, uncompressed array of intensity values or a compressed format such as that specified by ISO/IEC 15444.
The second format is based on a polar image specification that requires certain pre-processing and image segmentation steps, but produces a much more compact data structure that contains only iris information.

Data that comply with either one of the iris image formats specified in ISO/IEC 19794-6:2005 are intended to be embedded in a CBEFF-compliant structure in the CBEFF Biometric Data Block (BDB) as specified in ISO/IEC 19785-1.

ISO/IEC 19794-7:2007 specifies two data interchange formats for signature/sign behavioural data captured in the form of time series using devices such as digitizing tablets or advanced pen systems. One data interchange format is for general use and the other one is a compact format for use with smart cards or other tokens. Both data interchange formats can be used for both acquired signature/sign samples (serving as a starting point for feature extraction) and for time-series features (to be compared directly by time-series based comparison algorithms). Abstract syntax notation one (ASN.1) specifications of the data interchange formats and encoding instructions are provided in an informative annex.

ISO/IEC 19794-8:2006 specifies the interchange format for the exchange of pattern-based skeletal fingerprint recognition data. The data format is generic, in that it may be applied and used in a wide range of application areas where automated fingerprint recognition is involved.

The exchange format defined in ISO/IEC 19794-8:2006 describes all characteristics of a fingerprint in a small data record. Thus it allows for the extraction of both spectral information (orientation, frequency, phase, etc.) and features (minutiae, core, ridge count, etc.). Transformations like translation and rotation can also be accommodated by the format defined herein.

ISO/IEC 19794-8:2006 supports the proliferation of low-cost commercial fingerprint sensors with limited coverage, dynamic range, or resolution. Thus it defines a data record that can be used to store biometric information on a variety a storage media (including, but not limited to, portable devices and smart cards).

ISO/IEC 19794-9:2007 defines the exchange of human vascular biometric image information. It defines a specific definition of attributes, a data record format for storing and transmitting vascular biometric images and certain attributes, a sample record and conformance criteria.

ISO/IEC 19794-9:2007 is intended for applications requiring the exchange of raw or processed vascular biometric images. It is intended for applications not limited by the amount of storage required. It is a
compromise or a trade-off between the resources required for data storage or transmission and the potential for improved data quality/accuracy. Basically, it is to enable various algorithms to identify or verify the vascular biometric image data transferred from other image sources. Currently available vascular biometric technologies that may utilize ISO/IEC 19794-9:2007 for image exchange are technologies that use the back of the hand, palm and finger.

ISO/IEC 19794-10:2007 specifies a data record interchange format for storing, recording and transmitting the information from one or more hand silhouettes within a Common Biometric Exchange Formats Framework (CBEFF) data structure. It defines the content, format and units of measurement for the exchange of hand silhouette data that may be used in the verification or identification process of a subject. 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 measurements.

ISO/IEC 19795-1:2006 is concerned with the evaluation of biometric systems in terms of error rates and throughput rates. Metrics for the various error rates in biometric enrolment, verification and identification are unambiguously specified. Recommendations and requirements are given for the conduct of performance evaluations through the steps of planning the evaluation; collection of enrolment, verification or identification transaction data; analysis of error rates; and the reporting and presentation of results. The principles presented are generic to the range of biometric modalities, applications, and test purposes, and to both offline and online testing methodologies. These principles help avoid bias due to inappropriate data collection or analytic procedures; give better estimates of field performance for the expended effort; and clarify the limits of applicability of the test results.

ISO/IEC 19795-2:2007 addresses two specific biometric performance testing methodologies: technology and scenario evaluation. The large majority of biometric tests are of one of these two generic evaluation types. Technology evaluations evaluate enrolment and comparison algorithms by means of previously collected corpuses, while scenario evaluations evaluate sensors and algorithms by processing of samples collected from Test Subjects in real time. The former is intended for generation of large volumes of comparison scores and candidate lists indicative of the fundamental discriminating power of an algorithm. The latter is intended for measurement of performance in modeled environments, inclusive of Test Subject-system interactions. ISO/IEC 19795-2:2007 provides requirements and recommendations on data collection, analysis
and reporting specific to the two primary types of evaluation: technology evaluation and scenario evaluation.

It specifies requirements in the following areas:

- development and full description of protocols for technology and scenario evaluations;
- execution and reporting of biometric evaluations reflective of the parameters associated with biometric evaluation types.

In biometric performance testing and reporting, careful consideration needs to be given to the characteristic differences of each modality (fingerprint, face, iris, etc.). These differences naturally require variations within the general methodology defined in ISO/IEC 19795-1.

ISO/IEC TR 19795-3:2007 describes the methodologies relating to these modality-dependent variations. It presents and defines methods for determining, given a specific biometric modality, how to develop a technical performance test.

ISO/IEC 19795-4:2008 prescribes methods for technology and scenario evaluations of multi-supplier biometric systems that use biometric data conforming to biometric data interchange format standards.

It specifies requirements needed to assess

- performance available from samples formatted according to a standard interchange format (SIF),
- performance available when samples formatted according to a SIF are exchanged,
- performance available from samples formatted according to a SIF, relative to proprietary data formats,
- SIF interoperability by quantifying cross-product performance relative to single-product performance,
- performance available from multi-sample and multimodal data formatted according to one or more SIFs, and
- performance interoperability of biometric capture devices.

In addition, ISO/IEC 19795-4:2008

- includes procedures for establishing an interoperable set of implementations,
- defines procedures for testing interoperability with previously established sets of implementations, and
- gives testing procedures for the measurement of interoperable performance.
ISO/IEC 24709-1:2007
Information technology -- Conformance testing for the biometric application programming interface (BioAPI) -- Part 1: Methods and procedures

ISO/IEC 24709-1:2007 specifies the concepts, framework, test methods and criteria required to test conformity of biometric products claiming conformance to BioAPI (ISO/IEC 19784-1). Guidelines for specifying BioAPI conformance test suites, writing test assertions and defining procedures to be followed during the conformance testing are provided. The conformance testing methodology is concerned with conformance testing of biometric products claiming conformance to BioAPI. Definitions of schemas of the assertion language are provided in normative annexes.

Information technology -- Conformance testing for the biometric application programming interface (BioAPI) -- Part 2: Test assertions for biometric service providers

ISO/IEC 24709-2:2007 defines a number of test assertions written in the assertion language specified in ISO/IEC 24709-1. These assertions enable a user of ISO/IEC 24709-2:2007 (such as a testing laboratory) to test the conformance to ISO/IEC 19784-1 (BioAPI 2.0) of any biometric service provider (BSP) that claims to be a conforming implementation of that International Standard. Each test assertion specified in ISO/IEC 24709-2:2007 exercises one or more features of an implementation under test. Assertions are placed into packages (one or more assertions per package) as required by the assertion language. These assertions allow for testing conformance of BSPs of all conformance subclasses, and are further organized according to conformance subclasses and claimed support of optional features.

ISO/IEC 24713-1:2008
Information technology -- Biometric profiles for interoperability and data interchange -- Part 1: Overview of biometric systems and biometric profiles

ISO/IEC 24713-1:2008 provides common definitions used within the profile standards and references other standards applicable to the successful implementation of a generic biometric system.

A harmonized (with the other part 1 standards in WG 3 and WG5) generic biometric system is described and a diagram is present. The description includes detail of the individual components present in a generic biometric system.

ISO/IEC 24713-1:2008 furthermore describes the generic functions of the biometric system and the relationship between a biometric system and the application that uses that system.

Lastly, ISO/IEC 24713-1:2008 details the possible interfaces into a biometric system as well as the relationship that exists between the various base standards currently under development within SC37.
ISO/IEC 24713-2:2008 specifies the application profile including necessary parameters and interfaces between function modules (i.e. BioAPI based modules and an external interface) in support of token-based biometric identification and verification of employees, at local access points (i.e. doors or other controlled entrances) and across local boundaries within the defined area of control in an airport. The token is expected to contain one or more reference biometrics, one or more operational biometrics, or both.

ISO/IEC TR 24722:2007 provides a description of and analysis of current practice on multimodal and other multibiometric fusion, including (as appropriate) reference to a more detailed description. It also discusses the need for, and possible routes to, standardization to support multibiometric systems.

ISO/IEC TR 24741:2007 describes the main biometric technologies, with some historical information. An annex describes the work of creating International Standards for biometrics and provides a layered model for the placement of the various International Standards being produced, with a short description of each. A second annex contains some of the terms and definitions currently used in these International Standards or the drafts of these International Standards.