TECHNICAL REPORT

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Second edition
2015-12-15

Information technology — Biometrics — Multimodal and other multibiometric fusion

Technologies de l'information — Biométrie — Fusion multimodale et autre fusion multibiométrique

Contents

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

This second edition cancels and replaces the first edition (ISO/IEC/TR 24722:2007), which has been technically revised with the following changes:

— the original Clause 2 (Terminology issues) and Clause 7 (Scope and options for standardisation) are removed in this edition;

— Clause 2 (Terms and definitions) is aligned with ISO/IEC 2382-37;

— the current Clause 3, Clause 4, and Clause 5 have been technically revised in terminology, the state of arts updates, and other aspects. Such modifications have also been reflected in the bibliography.

Introduction

Some applications of biometrics require a level of technical performance that is difficult to obtain with a single biometric measure. Such applications include prevention of multiple applications for national identity cards and security checks for air travel. In addition, provision is needed for people who are unable to give a reliable biometric sample for some biometric characteristic types.

Use of multiple biometric measurements from substantially independent biometric sensors, algorithms, or characteristic types typically gives improved technical performance and reduces risk. This includes an improved level of performance where not all biometric measurements are available such that decisions can be made from any number of biometric measurements within an overall policy on accept/reject thresholds.

Of the various forms of multibiometric systems, the potential for multimodal biometric systems, each using an independent measure, has been discussed in the technical literature since at least 1974.[22][45] Advanced methods for combining measures at the score level have been discussed in Reference [15] and Reference [16]. At the current level of understanding, combining results at the score level typically requires knowledge of both genuine and impostor distributions. All of these measures are highly application dependent and generally unknown in any real system.

Research on the methods not requiring previous knowledge of the score distributions is continuing and research on fusion at both the image and feature levels is still progressing.

Given the current state of research into those questions and the highly application-dependent and generally unavailable data required for proper fusion at the score level, work on multibiometric fusion can, in the meantime, be considered mature. By intention, this Technical Report is not issued as an International Standard, in order not to force industrial solutions to conform to the methodology described herein. However, this Technical Report revision provides a mature technical description for developments of multibiometric systems. It will also provide a reference on multibiometric fusion for developers of other biometric standards and implementers.

Information technology — Biometrics — Multimodal and other multibiometric fusion

1 Scope

This Technical Report contains descriptions of and analyses of current practices on multimodal and other multibiometric fusion, including (as appropriate) references to more detailed descriptions.

This Technical Report contains descriptions and explanations of high-level multibiometric concepts to aid in the explanation of multibiometric fusion approaches including multi-characteristic-type, multiinstance, multisensorial, multialgorithmic, decision-level and score-level logic.

2 Terms and definitions

The following two categories of terms are defined here:

— terms that are specific to multimodal and multibiometric systems;

— terms that are not specific to multimodal and multibiometric systems, but are required to define the terms in the first category and not defined in the latest revision of ISO/IEC 2382-37.

For definitions of other terms in the subject field of biometrics, refer to ISO/IEC 2382-37. For the purposes of this document, the terms and definitions given in ISO/IEC 2382-37 and the following apply.

2.1
biometric data source
information channel (e.g. sensors, characteristic types, algorithms, instances or presentations) that is the origin of data (e.g. captured biometric sample, extracted features, comparison score, rank or decision) treated in fusion algorithms

2.2
biometric process
automated process using one or more biometric characteristics of a single individual for the purpose of enrolment, verification, or identification

2.3
biometric fusion
combination of information from multiple sources, i.e., sensors, characteristic types, algorithms, instances or presentations

2.4
cascaded system
system where pass/fail thresholds of biometric samples are used to determine if additional biometric samples are required to reach an overall system decision

2.5
layered system
system where individual biometric scores are used to determine the pass/fail thresholds of other biometric data processing

2.6
multialgorithmic
using multiple algorithms for processing the same biometric sample