

First edition  
2007-07-01

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**Information technology — Biometrics —  
Multimodal and other multibiometric  
fusion**

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

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Reference number  
ISO/IEC TR 24722:2007(E)



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Published in Switzerland

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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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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 TR 24722, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

## 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 modalities.

Use of multiple biometric measurements from substantially independent biometric sensors, algorithms or modalities 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, 49]. Advanced methods for combining measures at the score level have been discussed [15, 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 multimodal and other multibiometric fusion was considered not sufficiently mature to initiate an International Standard on the subject. Instead, it was considered appropriate to publish a Technical Report on the subject. This Technical Report is meant to provide information for future development of standards on multibiometric systems, in particular regarding the various aspects of fusion. 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. It also discusses the need for, and possible routes to, standardisation to support multibiometric systems.

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