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IEEE Standard for Biometric Liveness Detection

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Developed by the
Cybersecurity and Privacy Standards Committee

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of the
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Abstract: A biometric lifeless attack is one of the indispensable issues within biometric authentication. There are three major components in liveness detection systems: lifeless attack presentation, liveness detection, and lifeless attack instruments. The lifeless attack presentation is divided into artifact presentation and human-based presentation. The liveness detection method includes subject-based and scenario-based solutions, as well as other attributes such as decision elements, detection patterns, and implementations. The lifeless attack instrument is specified from aspects such as production elements, production types of artifacts, efficacy, etc. This document establishes terms and definitions in the field of biometric liveness detection and identifies characterizations of lifeless attack and liveness detection methods, with analysis on lifeless attack instruments. In addition, this document specifies the liveness detection process, implementation model, and metrics.

Keywords: IEEE 2790™, lifeless attack, lifeless attack instrument, liveness detection, presentation attack detection

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Chen Gu, *Chair*
Wei Guo, *Vice Chair*
Qi Wang, *Secretary*

0xSenses Corporation
Alipay (China) Technology Co.,
Ltd

China Academy of Information and
Communications Technology
China Electronics Standardization
Institute

Irisian Optronics Technology
SenseTime

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ChunPei Feng
Shan Fu
YaZhuo Gong

Hui Jiang
JiaYang Li
WenFeng Wang
HongWei Luo

LiWei Wu
Yu Yuan
Chen Zhong

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0xSenses Corporation
Alibaba
Alipay (China) Technology Co., Ltd
BII Group Holdings Ltd.
Chaincomp Technologies Co., Ltd.
China Academy of Information and
    Communications Technology
    (China Academy of TeleCommunication
    Research, MIIT) CAICT (CATR)

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Kevin Lu
Paul Nikolich
Damir Novosel
Dorothy Stanley

Mehmet Ulema
Lei Wang
Sha Wei
Philip B. Winston
Daidi Zhong
Jingyi Zhou

*Member Emeritus

Introduction

With the rapid development of mobile device capability in computation and functionality, especially in consumer intelligent mobile devices, urgent demand for strong identity authentication in cyberspace becomes increasingly important. Traditional models, such as password, short message, band card verification, security questions, etc., cannot meet the challenges because they are vulnerable to attacks and are inconvenient to store or remember.

There are three types of authentication methodologies: what you know, what you have, and who you are.

Biometric-based authentication is a typical who you are methodology. Biometrics are used to recognize individuals based on biological and behavioral characteristics. More biometric authentication technologies, such as fingerprinting, face imaging, and iris imaging, have been adopted by intelligent terminals and widely applied in various scenarios.

Biometric authentication has become more widespread in daily life because of its convenience, portability, unique, universal, and acceptable characteristics.

Biometric authentication brings users convenient access, however, it presents some special security challenges that will result in severe problems if not resolved properly. Notably, the possibility of subversion of the system has been widely acknowledged, which is called a presentation attack. The countermeasures to automated detection of presentation attacks undertaken by biometric capture subjects are collectively called presentation attack detection (PAD).

Liveness detection is an important part of PAD, indispensable in biometrics. If subverters attack biometric data by using an artificial subject or some part from a dead person, and the biometric system cannot identify and handle such an attack, the whole biometric system is vulnerable. A biometric liveness attack presents a biometric sample to a biometric capture subsystem through an artifact from a deceased person. Biometric liveness detection determines if a biometric sample is being captured from a living subject present at the point of capture. Considering that different lifeless attack detection (LAD) methods have different characteristics and act as countermeasures of different kinds of lifeless attack instruments (LAIs), different scenarios require different LAD methods, and different biometric modalities adopt different LAD methods. This standard introduces basic concepts, analyses the LAIs and LADs, describes biometric modality-specific LADs, and specifies metrics.

Contents

IEEE Standard for Biometric Liveness Detection

1. Overview

1.1 Scope

This document establishes terms and definitions in the field of biometric liveness detection and identifies characteristics of lifeless attacks and liveness detection methods, with analysis of lifeless attack instruments (LAIs). In addition, this document specifies liveness detection process and metrics.

The following is outside of the scope of this document:

— Standardization of specific liveness detection methods

— Detailed information about countermeasures, algorithms, or sensors

— Overall system-level security

— Security evaluation and vulnerability assessment

— Integrated implementation of liveness detection subsystem within general biometric framework

1.2 Purpose

This document provides a foundation for biometric liveness detection through which lifeless attacks can be specified, detected, and subsequently categorized and analyzed for biometric system performance.

1.3 Word Usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals is *required to*).[1,2]

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals is *recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals is *permitted to*).

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[1]The use of the word *must* is deprecated and cannot be used when stating mandatory requirements, *must* is used only to describe unavoidable situations.
[2]The use of *will* is deprecated and cannot be used when stating mandatory requirements, *will* is only used in statements of fact.

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