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Information technology — A study of the differential impact of demographic factors in biometric recognition system performance

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Foreword

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Introduction

Automated systems (including biometrics) are increasingly used in decision-making processes. In recent years, systemic performance differentials reflected in several automated decision systems have been reported and hotly debated. In the context of this report, an algorithm exhibiting performance differentials produces statistically different outcomes or decisions for different groups of individuals, for example, based on gender, age and race/ethnicity. In the context of biometric recognition, this means that probabilities of false positives and/or false negatives can differ among the demographic groups. The impacts of such performance differentials on the affected individuals can range from mere inconvenience in cooperative access control systems, to consequential harms such as varying arrest rates for certain demographic groups based on decisions produced by facial recognition systems.

Although such systems are almost certainly not designed to be explicitly differential against any group, implicit differences can occur independently of the intentions of the system designers. They can be exhibited and propagated at many stages of the decision-making pipeline, including but not limited to training data itself as well as the data processing. Due to the scalability of such systems, a higher quantity of erroneous or inaccurate decisions can be generated than in the typical, human-based processes. Consequently, in recent years, measuring and ensuring the fairness (i.e. lack of differential performance) of such systems has often been discussed in the media and political circles, with research and commercial interest increasing accordingly. With increasing deployments of the technology, it is important to consider whether it performs similarly for all users. This document helps to identify where recognition performance differences related to demographic factors can exist in biometric systems.

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Information technology — A study of the differential impact of demographic factors in biometric recognition system performance

1 Scope

This document introduces the effects of population demographics on biometric functions. It:

— establishes terms and definitions relevant to the study of demographic factors in biometric recognition system performance;

— identifies areas where biometric systems can exhibit different performances based on different demographic factors of the individuals submitting the biometric samples;

— explains how different demographic factors can influence the biometric characteristics captured by different biometric modalities and how these influences can affect biometric performance measures;

— presents a case study on existing scientific material that explores the impact of demographic factors on biometric system performance. Only biometric modalities where quantitative information is available on the impact of demographic factors are considered.

Outside of the scope of this document are:

— effects of disease and injury on biometric performance; and

— how religious and cultural norms can affect biometric operations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 2382-37, *Information technology — Vocabulary — Part 37: Biometrics*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms, definitions, symbols and abbreviated terms given in ISO/IEC 2382-37 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
age
length of time an individual has lived

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