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Section 2

Facial Comparison Overview

(This document is being published as a Guideline)

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Purpose

This document is intended to provide an overview of how facial comparisons are used in the security, intelligence, law enforcement, and forensic communities. Facial comparison should not be confused with human facial recognition, which is matching a face to a face held in memory.

Introduction

Facial comparison is a manual process undertaken by a human. While similar to other comparative analyses, facial comparison requires specific domain knowledge and expertise that may include, but is not limited to, knowledge of image science, human anatomy, and statistical analysis. The level of knowledge necessary to conduct facial comparisons is dependent upon the purpose of the analyses.

In this document, the term facial comparison refers to both facial examinations and facial reviews as performed by humans. Facial examination involves a rigorous process, while facial review is less rigorous. The level of training required for each comparison process will be addressed in FISWG documents—*Guidelines and Recommendations for Facial Comparisons* and *Training to Competency*.

Facial comparison has many applications and the methods used to compare faces will often depend on the purpose of the comparison. A number of factors should be taken into consideration when reaching a conclusion and each application requires its own level of justification. While organizations engaged in facial comparison are expected to have general quality management systems in place, there will be a number of quality considerations specific to this discipline.

Applications

Facial comparisons are performed for a number of reasons and the level of evaluation should be commensurate to the possible consequences to a subject, organization, or community. Comparisons that need to be immediate and/or whose consequences are less severe require less stringent processes than those whose consequences are more severe. For example, in screening and access control the examiner might be expected to evaluate hundreds of comparisons a day whereas a forensic identification will require a more detailed and time consuming examination.

While most applications fall primarily in one of the following four categories, it should be noted that crossover exists.

- **Intelligence Gathering for Identity Management** – These comparisons are a component of the collation of information relating to what is believed to be one person.
- **Screening and Access Control** – These include both image-to-image and image-to-person comparisons. Both involve a large volume of comparisons, and in these environments, quick turnaround is warranted.
- **Investigative and Operational Tool** – These comparisons provide information, generally not intended for court purposes, to operational personnel to assist them with meeting their objective.
- **Forensic Identification** – These comparisons provide information to assist a trier of fact (e.g., judge or jury). The accuracy and reliability of comparisons, based on sound scientific principles, is of primary concern in this environment.

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Automated facial recognition systems that provide a one-to-many search typically necessitate a subsequent one-to-one comparison by a human operator, referred to as facial review.

General Procedures

Dependant on the purpose of comparison, procedures may include all or some of the following steps: assessment, examination, evaluation, conclusions, and quality management. These steps will be addressed in future FISWG documents.

- **Assessment** - This step involves the assessment of available images with respect to quality factors, such as image resolution, focus, pose, illumination, and expression. The purpose of assessment may be to ensure that images meet an established quality criterion for submission to a facial recognition system or that the images are suitable for a meaningful facial review and/or examination.
- **Examination** - This step may include any pre-processing of the images prior to comparison. See Section 5 of the Scientific Working Group for Imaging Technology (SWGIT) *Guidelines for Image Processing*. The facial comparison method(s), as described below, are selected and applied in order to make and, when required, record observations.
- **Evaluation** -There are a number of factors that need to be taken into consideration when evaluating the significance of similarities and/or differences observed during the facial comparison process. These may include, but are not limited to, imaging conditions, persistence and relative frequency of facial features, environmental factors, and aging. A facial examination should include an assessment of the significance and weight of observed similarities and differences under competing hypotheses.
- **Conclusions** - Facial comparison leads to an action, the nature of which is determined by the purpose of the examination. In some cases, actions might include granting or denying access or inclusion into a dataset, while in other cases, the action is the creation of a written report. Presently, a probabilistic model based on population statistics of facial features is not available. Therefore, findings are usually reported on a descriptive scale for which there is no current standard. A standard scale and recommendations for reporting will be addressed in future FISWG documents.
- **Quality Management** –FISWG recommends that all facial comparisons be subject to quality control and assurance measures commensurate to the application.

Current Methods

FISWG recognizes the need to extend work on validating existing methods. Currently, there are four main facial comparison methodologies in use: holistic comparison, morphological analysis, photo-anthropometry, and superimposition. Holistic comparison and morphological analysis are suited to both image-to-person and image-to-image comparisons. However, photo-anthropometry and superimposition are only suitable for image-to-image comparisons. Not all methods are suitable to every application or image set under examination.

- **Holistic comparison** is the process of comparing faces by looking at the face as a whole, taking into account all the features of the face simultaneously. It does not specifically explain the basis for reaching a conclusion on similarity.
- **Morphological analysis** is a method of facial comparison in which the features of the face are described, classified, and compared. Conclusions are based on subjective observations.
- **Photo-anthropometry** is the measurement of dimensions and angles of anthropologic landmarks and other facial features in order to quantify characteristics and proportions. The measurements taken from one image are then compared to the measurements taken from a separate facial image. Conclusions are based on subjective thresholds for acceptable differences between measurements.
- **Superimposition** is the process of creating a scaled overlay of one image and aligning it with a second image. It is an aid to visual comparison and is utilized when two images are taken from the same angle. Superimposition is

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commonly used in conjunction with other methods to form a conclusion.

Ongoing Efforts

Further work is necessary to set standards and advance the state of the science for current and emerging methodologies for facial comparisons. FISWG intends to promote research and help focus efforts to accomplish these goals. A key objective of FISWG is to share this information with the wider community. Future FISWG documents will address in detail: procedures, methodologies, evaluations and conclusions, scale of support, quality management, and validation.

FISWG documents may be found at: www.FISWG.org

Section	Title
Section 1	Glossary
Section 2	Facial Comparison Overview
Section 3	Guidelines and Recommendations for Facial Comparison Training to Competency
Section 4	Guidelines for Specifications, Procurement, Deployment, and Operations of Facial Recognition Systems
Section 5	
Section 6	
Section 7	
Section 8	
Section 9	
Section 10	

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