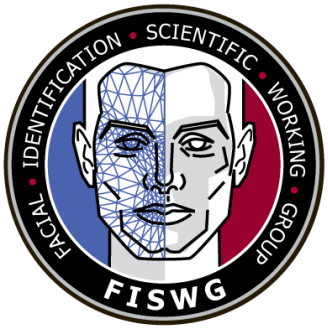


## Disclaimer:

As a condition to the use of this document and the information contained herein, the Facial Identification Scientific Working Group (FISWG) requests notification by e-mail before or contemporaneously to the introduction of this document, or any portion thereof, as a marked exhibit offered for or moved into evidence in any judicial, administrative, legislative, or adjudicatory hearing or other proceeding (including discovery proceedings) in the United States or any foreign country. Such notification shall include: 1) the formal name of the proceeding, including docket number or similar identifier; 2) the name and location of the body conducting the hearing or proceeding; and 3) the name, mailing address (if available) and contact information of the party offering or moving the document into evidence. Subsequent to the use of this document in a formal proceeding, it is requested that FISWG be notified as to its use and the outcome of the proceeding. Notifications should be sent to: chair@fiswg.org

## Redistribution Policy:

FISWG grants permission for redistribution and use of all publicly posted documents created by FISWG, provided that the following conditions are met:

Redistributions of documents, or parts of documents, must retain the FISWG cover page containing the disclaimer.

Neither the name of FISWG, nor the names of its contributors, may be used to endorse or promote products derived from its documents.

Any reference or quote from a FISWG document must include the version number (or creation date) of the document and mention if the document is in a draft status.

# Image Processing Techniques for Facial Image Comparison



## 1. Scope

1.1 This document outlines image processing techniques to be used with analysis and comparison of facial images.

1.2 This document does not discuss image processing techniques for searching an image in a facial recognition system. (See FISWG Standard Practice for Image Processing to Improve Automated Facial Recognition Performance.)

## 2. Referenced Documents

2.1 *ASTM Standards:*[1]

ASTM E2825 Standard Guide for Forensic Digital Image Processing

2.2 *FISWG Standards*:[2]

FISWG Guide for Facial Comparison Training of Reviewers to Competency

[1] For referenced ASTM standards, visit www.nist.gov/osac/astm-launch-code, or the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

[2] Available from Facial Identification Scientific Working Group, https://fiswg.org.

FISWG Guide for Facial Comparison Training of Examiners to Competency

## 3. Terminology

3.1 *Definitions:*

3.1.1 *lossless compression*– a data reduction process that is completely reversible, such that all the original data can be retrieved in the original form.

3.1.2 *working copy*– a copy or duplicate of a recording or data that can be used for subsequent processing and/or analysis.

3.1.3 *case original image*— the first iteration of the image that was received in a case.

## 4. Recommended Guidelines

4.1 These guidelines should be used by reviewers and examiners when and if applying image processing techniques to image(s) in a comparison.

4.2 It is imperative to preserve the case original image(s) and image processing shall only be done on a working copy.

4.3 The practitioner should apply the minimum amount of image processing to the images. They should have up to date knowledge and experience in image processing techniques including the potential effects on the image, which may affect the

interpretation of the visual analysis. All image processing techniques shall be made over the whole image and not in localized areas.

4.4 Below is a list of recommended image processing techniques which introduce the least amount of alterations/manipulation to the image. When applying any of the techniques below, caution should be taken as extensive use may introduce changes or alter the image in an unforeseen way.

4.4.1 Other image processing techniques outside of this list are not recommended without the practitioner having a thorough understanding of how that technique works.

## 5. Image Processing Techniques

5.1 The processed image should be saved in a lossless compression format (e.g., .jp2, .tif, .png, .bmp, .raw).

5.1.1 Brightness is used when the original image is too bright or too dark.

5.1.2 Cropping is used to isolate the subject of interest in an image. Images should be cropped in a way that avoids resampling or compression as this could degrade image quality.

5.1.3 Rotation is used to change the vertical orientation (y-axis) of the image. Images can be rotated in a 90-degree interval, clockwise or counterclockwise, without affecting the visual detail. A free or arbitrary rotation risks introducing artifacts due to interpolation and should be avoided.

5.1.4 Levels is used to correct the tonal range of an image, including the intensity levels of image shadows, midtones, and highlights.

5.1.5 Grayscale is used to remove color information and only leaves different shades of gray. Use of this technique may eliminate finer tonal variations. Grayscale may be used to aid in comparisons where the images differ in available color information.

5.1.6 Mirroring/Flipping is used to correct the horizontal orientation (x-axis). This technique should only be used when an image is suspected to be reversed, either due to background information or feature position. Mirroring of original image should be confirmed before progressing with the comparison, to avoid forcing feature correspondence.

5.1.7 Zoom is used to temporarily enlarge an area of interest in the image. When using the zoom feature, practitioners should be aware some software may interpolate the image. Practitioners should attempt to use a system where there is an option to turn interpolation off to preserve visual details.

## 6. Proper Documentation

6.1 The practitioner shall document image processing steps taken, the software used, and the software version. The processing steps should be documented in a manner sufficient to permit a comparably trained practitioner to understand the steps

taken and replicate the techniques used to extract comparable information from the image(s).

FISWG documents can be found at: www.fiswg.org