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Guidelines for Image Processing Techniques in 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

FISWG Guide for Facial Comparison Training of Examiners to Competency

3. Terminology

3.1 Definitions:

3.1.1 *lossless compression, n*—file size reduction process in which no data is lost and all data can be retrieved in its original form (e.g., TIF with LZW compression).

3.1.2 *working copy, n*—a copy or duplicate of a recording or data that can be used for subsequent processing, analysis, or both.

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>.

3.1.3 *case original image, n*— the original submitted case image that was received.

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 an analysis or 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, if necessary. 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.

4.4 Below is a list of recommended image processing techniques which introduce the least amount of alterations 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).

5.2 Brightness, contrast, and gamma are used to adjust the gray levels of the working copy of the image.

5.3 Cropping is used to isolate the subject of interest in an image.

5.4 Rotation is used to change the vertical orientation (y-axis) of the image. Where 90-degree interval rotation cannot be utilized for orienting facial images correctly, free rotation may be utilized. Practitioners should be aware that free rotation can introduce artifacts due to interpolation.

5.5 Levels is used to correct the tonal range of an image, separately adjusting the intensity levels of image shadows, midtones, and highlights.

5.6 Conversion to 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.

5.7 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(s) should be confirmed before progressing with the comparison, to avoid forcing feature correspondence.

5.8 The zoom feature of image visualization software may be used to temporarily enlarge an area of interest in the image. The practitioner should be aware that zooming in or out requires some form of interpolation and should be cognizant that different interpolation algorithms produce different artifacts in the interpolated image.

5.9 Scaling (increasing or decreasing the size of an image) is used to orient the images in a 'like for like' format. The practitioner should be aware that scaling in or out requires some form of interpolation and should be cognizant that different interpolation algorithms produce different artifacts in the interpolated image.

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).

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