



### **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](mailto: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.



## Glossary

### **Accessories**

Removable items (e.g. glasses, sunglasses, colored contact lenses, Bluetooth devices, headphones, piercings, and bandages) that are worn on, in or near the face that may obstruct any head, face or neck features.

### **ACE-V**

Acronym for Analysis, Comparison, Evaluation - Verification. A scientific method utilized in most comparative processes.

### **Ad Hoc Image**

See *Uncontrolled Image*.

### **AFR**

Acronym for Automated Facial Recognition.

### **Alterations**

Refers to any intentional modification to the face with the exception of scarring.

### **Analysis**

(1) The assessment of an image to determine suitability for comparison, including the ability to discriminate significant features. (2) The first step of the ACE-V method.

### **Anthropometry**

Scientific study of the measurements and proportions of the human body.

### **Aspect Ratio**

Ratio of width to height. This can be specific to pixels or images.

### **Assessment**

A quick image-to-person or image-to-image comparison typically conducted in a high throughput environment (e.g., screening and access control applications or field operations).

**Atmospheric Distortion**

Uneven magnification or illumination of elements within an image that may obscure details.

**Backlight**

A light source placed behind a subject in a controlled capture that reduces background shadows.

**Barrel Distortion**

Straight lines appearing to bend away from the center of the image, with the center of the image enlarged.

**Batch Mode Search**

A mode of searching in which a group of probes are simultaneously or sequentially launched. Such computer resource intensive searches are usually performed during non-peak usage hours (e.g., nights or weekends). Also known as batch search mode.

**Bias**

An inclination of temperament or outlook. (Webster). A systemic tendency to over- or under-estimate the true value of a measurement. Bias can result from human factors or from factors related to the method or calculation being used.

See also *Cognitive Bias*, *Confirmation Bias*, and *Contextual Bias*.

**Binning**

(1) Any technique used by a Facial Recognition System (FRS) to organize or optimize searching based upon some piece(s) of metadata. (2) Process of parsing (examining) or classifying data in order to accelerate and/or improve biometric matching.

**Biometric Match**

A determination that two biometric samples (see biometrics below) correspond to the same source based on some level of computer-evaluated similarity. This does not inherently imply that the probe and candidate are the same person.

**Biometrics**

The measurement and analysis of unique physical or behavioral characteristics, especially as means of verifying a personal identity (Webster).

**Capture**

The process of collecting a biometric sample from an individual.

**Certification Authority**

A body that issues a (biometric) document and certifies that the data stored on the document is genuine.

**CCTV**

An acronym for Closed Capture Television.

**Characteristic Descriptors**

Minutiae of the component characteristics.

**Cheeks**

Refers to the regions of the face surrounded by the eyes, ears, nose, mouth, chin, and jawline.

**Chin**

Refers to the area of the face defined by the lower jaw below the mouth.

**Chromatic Aberration**

Color fringing that creates color and tonal changes in the high contrast areas of an image.

**Class Characteristics**

Characteristics common to many individuals within a group (e.g., the overall shape of the nose, eyes, or mouth).

**Clustering**

The automated grouping of people represented within a collection of facial images based on computer evaluated similarity.

**Cognitive Bias** (1) A mental error caused by one's simplified information processing strategies. It does not result from any emotional or intellectual predisposition toward a certain judgment, but rather from subconscious mental procedures for processing information. (2) A mental error that is consistent and predictable. (3) Influences that may affect the reliability and validity of one's observations and conclusions.

**Color Depth**

The bit scale of the image, e.g. 8 bit grayscale and 24 or 48 bit RGB (Red, Green, Blue).

**Color Misrepresentation**

A change in the actual color of subjects or objects depicted in an image.

**Comparison**

The second step of the ACE-V method; the examination of two or more samples to establish similarities and dissimilarities.

**Complex Distortion**

A combination of both barrel and pin cushioning, and can result in uneven magnification of the image.

**Compression**

The process of reducing the size of a data file.

**Conclusion**

A reasoned deduction or inference.

**Confirmation Bias**

Tendency to focus on data or interpret information in a manner that supports one's preconceptions.

**Contextual Bias**

Influence of extraneous information that is not needed to draw the conclusion.

**Control**

A sample or standard against which other conditions can be compared in a scientific experiment.

**Controlled Image**

An image captured in accordance with facial identification (FI) or facial recognition (FR) standards or guidelines.(e.g., a driver's license photo).

**CSI Effect**

The perception of the near-infallibility of forensic science in response to popular media.

**CYMK**

The color gamut spectrum widely used in printing. Cyan, Magenta, Yellow, and black.

**Descreen**

The array of dots used in the halftone or desktop printing processes is called a screen where the color dots are placed at different angles, and a scanning software option can be used to minimize the screen pattern by use of a screen frequency filter algorithm.

**Digital Zoom**

Method of decreasing the apparent angle of view of a digital image accomplished by cropping an image down to a centered area with the same aspect ratio as the original. Digital zoom could be misleading because it enlarges the image without adding extra details.

**DMV**

Acronym for Department of Motor Vehicles or Division of Motor Vehicles.

**Dots per Inch**

The resolution setting of the printer and resolution capture for printed media.

**DPI**

An acronym for Dots per Inch.

**Ears**

Refers to the external characteristics of the ears.

**Enroll**

The act of capturing a sample, creating a template, and entering the template into a database.

**Evaluation**

The third step of the ACE-V method, where an examiner assesses the value of the details observed during the analysis and comparison steps and reaches a conclusion. Ascertaining the value of dissimilarities and similarities between two facial images.

**Examination**

A comparison of image(s)-to-image(s) often used in a forensic application.

**EXIF**

(1) Acronym for exchangeable image file format. (2) EXIF is a specification for the image file format used by some digital cameras to add image capture metadata to file formats. EXIF headers can be found in file formats such as JPEG, TIFF, and RIFF WAV.

**Expression**

Change in facial characteristics resulting from muscle movement or position.

**Eyes**

Refers to the orbital region below the eyebrows and above the cheeks.

**Eyebrows**

Refers to the strips of hair above the eyes.

**Face Detection**

Automated determination of the locations and sizes of human faces in digital images.

**Face/Head Composition**

Overall configuration of the facial components, to include their alignment and relative sized, internal to a single face.

**Face/Head Outline**

Overall shape of the head (cranial vault) and face.

**Facial Assessor**

A human conducting a comparison in a high throughput environment (see Assessment).

**Facial Components**

Gross features considered in virtually all comparison.

**Facial Examination**

A human undertaking a formal systematic examination (e.g., ACE-V) of facial images to determine if the same person is depicted.

**Facial Hair**

Refers to the hair on the face typically covering the cheeks, chin/jaw, upper and lower lip, and neck of the face.

**Facial Identification (FI)**

A human undertaking a manual examination of the differences and similarities between facial images or between a live subject and facial images for the purpose of determining if they represent the same person.

**Facial Line**

Refers to wrinkles, folds, or creases.

**Facial Mapping**

(1) The process of locating defined anthropometric landmarks. (2) A colloquial term often mistakenly used to describe facial comparison.

**Facial Marks**

Refers to portions of the skin that contain a different level of pigment that the rest of the surrounding skin.

### **Facial Recognition (FR)**

The automated searching of a facial image (probe) against a known collection resulting in a list of candidates ranked by computer-evaluated similarity score. This is commonly referred to as a one-many comparison.

### **Facial Review**

(1) The review of a candidate list to identify possible matches. (2) One-to-one verification conducted in a high-throughput environment (e.g., border crossing).

### **Features**

(1) Observable class or individual characteristics of the face. (2) The components of biometric templates.

### **Feedback**

Information provided to trainees to minimize the gap between their current and optimal performance.

### **FI**

Acronym for Facial Identification.

### **Forensic Report**

A document whose intent it is to provide information to assist a trier of fact (e.g., judge or jury).

### **Forehead**

Refers to the part of the face above the eyes, including the brow ridges.

### **FR**

Acronym for Facial Recognition.

### **FRS**

Acronym for Facial Recognition System.

### **Frontal Pose**

A facial image captured directly in front of the subject with the focal plane approximately parallel to the plane of the subject's face.

### **Gallery**

The FR system's database, which typically contains all known-person templates.

### **Gnathism**

Apparent convexity or concavity of the mouth complex, related to the relative projection of the upper or lower teeth, or both).



### **Gonial Angle**

The point at which the lower border of the mandible abruptly changes direction from a primarily horizontal line to a primarily vertical line.

### **Guideline**

Recommended practice that allows some discretion or leeway in its interpretation, implementation, or use.

### **Hair**

Refers to the shape and distribution of head hair and does not include other facial hair (eyebrows, lashes, facial hair).

### **Head Coverings**

Removable objects (e.g. hats, caps, scarves, wigs, and spit masks) that obstruct any head, face or neck features.

### **Histogram**

A graph of a frequency distribution in which rectangles with bases on the horizontal axis are given widths equal to the class intervals and heights equal to the corresponding frequencies. In digital images, a histogram is frequently used to document the number of pixels of a given brightness value (e.g., 0-255).

### **Holistic Process**

The innate human ability of comparing faces by looking at the face as a whole without specifically considering the component parts in isolation.

### **Horizontal video misalignment**

Horizontal misalignment is observed where subjects and objects in the image are positioned differently between alternating horizontal lines of a video image.

### **Hot Spots**

Bright areas of light reflection that reduce the visibility of features.

### **Face Recognition**

A human cognitive process by which an observer identifies a person as being one they have seen before.

### **Identification**

A task where the biometric system searches a database for a reference matching a submitted biometric sample and, if found, returns a corresponding identity. Also see *Individualization*.

**Identity**

The collective set of biographic data, images, and/or templates assigned to one person.

**Individual Characteristics**

Characteristics allowing one to differentiate between individuals having the same class characteristics (e.g. scars and marks).

**Individualization**

The determination of an examiner that there is sufficient quality and quantity of detail in agreement to conclude that the images depict the same source.

**Intentional Alteration**

A temporary or permanent deliberation modification to the face (e.g., tattoos, piercings, make-up).

**Interpolation**

The process whereby the number of pixels comprising an image is increased based on the available pixels.

**Investigative Lead Report**

A document whose intent it is to provide information to operational personnel to assist them with meeting their objective.

**Jawline**

Refers to the area of the face defined by the lower border of the mandible between the chin and the gonial angle.

**Known image**

The image of an individual associated with a known or claimed identity and recorded electronically or by other medium (also known as exemplars).

**Lamina**

A clear/low opacity sheet of film or security designed film that is sealed onto a substrate by cold or hot adhesion.

**Lens Flare**

Haze, bright streaks, orbs, or polygonal bright regions within an images as a result of a bright light source.

**Levels of Conclusion**

A verbal or numeric scale that indicates the level of confidence regarding identification or exclusion of a source.

**Lighting**

The illumination of the subject.

**Lighting Direction**

The direction of the illumination source.

**Lights Out**

An automated conclusion based upon threshold scores with no human involvement.

**Lines per Inch**

A term in resolution setting in scanner software used for scanning original artwork for printing.

**LPI**

An acronym for Lines per Inch.

**Lossless Compression**

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).

**Lossy Compression**

File size reduction process in which data is lost and cannot be retrieved in its original form (e.g., high-compression JPEG).

**Make-up**

Removable cosmetics (e.g. costume make-up, excessive make-up, and facial make-up appendages) that are applied to the face that may obstruct any head, face or neck features.

**Match/Matching**

See *Identification*.

**Mentorship**

A program administered under the direction of a competent facial reviewer or examiner during the course of a trainee's professional development. Mentorship should include, but is not limited to, the evaluation of skills and competencies, the review and supervision of facial comparison casework, and where applicable, the observation of expert testimony.

**Mentor**

An individual who has competency, proficiency, and experience in the relevant role.

**Metadata**

Non image-based information associated with an image file.

**Mirroring**

An image flipped in the horizontal plane.

**Morphological Analysis**

The direct comparison of class and individual facial characteristics without explicit measurement. The method of facial comparison in which the features and components of the face are compared.

**Moiré**

A moiré pattern occurs when a scene or an object that is being scanned contains repetitive details (such as lines, circles, dots, etc.) that exceed the sensor resolution.

**Mouth**

Refers to the entire oral region including the teeth and encompasses the philtrum.

**Natural Expression**

An expression where the facial characteristics and muscles are relaxed.

**Neck**

Refers to the transitional zone between the head and the trunk/limbs of the body.

**Neutral Expression**

An expression where the eyes are open and the mouth is closed.

**Noise**

Fixed, random, and semi-random spots, shapes, or patterns.

**Nose**

Refers to the entire nasal region.

**Obstruction**

Any object that blocks features (e.g., sunglasses or objects in the environment, such as a tree) partially or in totality.

**Perspective**

Camera to subject geometry, including both camera to subject distance and orientation of the camera relative to the subject.

**Perspective Distortion**

Warping or transformation introduced to an object's appearance in an image caused by insufficient subject to camera distance (e.g., larger nose or smaller ears). Photographs made from a distance of less than two meters tend to introduce noticeable perspective distortion. Magnification of the subjects' features that are closer to the camera making them appear larger than those further away.

**Photo-Anthropometric Facial Comparison**

Explicit measurement of landmarks on the face and comparison of these measurements between images.

**Photographic Comparison**

An assessment of the correspondence between features in images and known objects/images for the purpose of rendering an identification, elimination, or a qualified conclusion (as opposed to a demonstrative exhibit). The measurement of dimensions and angles of anthropological landmarks and other facial features visible in an image in order to quantify characteristics and proportions.

**Pin-Cushioning Distortion**

Straight lines appearing to bend towards the center of the image, with the center of the image more compressed.

**Pitch**

The rotation in degrees about the (horizontal) x-axis. Frontal poses have a pitch angle of 0 degrees. Positive angles represent faces looking down (a counter-clockwise rotation around the x-axis). (ISO/IEC 19794-5).

**Pixels per Inch**

Measurements of the pixel density of an electronic image device, such as a computer monitor or camera.

**Poor Contrast**

The limited distribution or separation of light and dark.

**Pose**

The orientation of the face with respect to the camera, consisting of pitch, roll, and yaw. Common poses are frontal and profile.

**PPI**

An acronym for Pixels per Inch.

**Printed Image**

A printed image is the production of a digital image on a substrate by a direct or indirect printing process.

**Probabilistic Model**

Statistical analysis tool that estimates, on the basis of past (historical) data, the probability of an event occurring.

**Probe**

The facial image or template searched against the gallery in an FR system.

**Questioned image**

The image of an individual whose identity is unknown or in question and has been recorded.

**Raw**

A digital camera or scanner file format, usually proprietary, for minimally processed digital image data.

**Recognition**

(1) See *Facial Recognition*. (2) See *Face Recognition*.

**Registration**

(1) Enrollment of an identity in an application using a biometric system. (2) The process by which two facial images are sized and aligned with each other for direct comparison.

**Relative Frequency**

How often facial features or combinations thereof occur in a given population.

**Resolution**

The act, process, or capability of distinguishing between two separate but adjacent elements of detail in an image. Resolution normally has three components: spatial (e.g., pixels per inch), spectral (e.g., number of colors), and radiometric (e.g., number of shades).

**Review**

A comparison of image-to-image often used in either investigative and operational leads or intelligence gathering applications.

**RGB**

is a color gamut spectrum that stands for color channels Red, Green, and Blue.

**Roll**

The rotation in degrees about the z-axis (the horizontal axis from front to back). Frontal poses have a roll angle of zero degrees. Positive angles represent faces tilted toward their right shoulder (counter-clockwise rotation around the z-axis). A roll angle of zero degrees denotes that the left and right eye centers have identical Y coordinates (ISO/IEC 19794-5).

**Rolling Shutter Effect**

Skewing or stretching of fast moving objects in a an image where the sensor captures images line by line.

**Samples per Inch**

A generic term that can include of DPI, LPI, and PPI. SPI is the measurement of the resolution, in particular the number of individual samples that are taken in the space of one linear inch.

**SAP**

Acronym for Subject Acquisition Profile (see below).

**Scar**

Refers to dysmorphic or discolored areas or both of skin where permanent damage has healed (that is, not recent damage).

**Search**

The act of comparing a probe against a gallery.

**Search Result Set**

The candidate list returned from a search.

**Sharpness**

The overall clarity and detail of the facial features.

**Skin**

Refers to the overall appearance of the skin.

**SPI**

An acronym for Samples per Inch.

**Spoofing**

In a biometric system, the process by which an imposter intentionally attempts to be recognized as another person or intentionally attempts to be missed as an existing identity in the gallery.

**sRGB**

(1) Acronym for standard red, green, and blue. (2) Standard default color space used for the Internet and for displaying or printing images.

**Subject Acquisition Profile (SAP)**

Facial image capture criteria described in ANSI/NIST-ITL 1-2007 (e.g., SAP Level 40 includes the requirement for 768 x 1024 pixels).

**Substrate**

A substrate in printing terms is a form of media on which a printed image is produced.

**Superimposition**

The process of creating an overlay of two aligned images and comparing them visually.

**System Bias**

(1) Errors repeatedly introduced through automation (e.g., errors in template generation or comparison). (2) Errors repeatedly introduced through operational practices in an organization or unit (e.g., improper lighting or camera position guidance).

**Template**

A set of biometric measurement data prepared by an FR system from a facial image.

**Time-related changes**

The natural variations to the face that occur as a function of time.

**Uncontrolled Image**

An image not captured in accordance with FI/FR standards or guidelines (e.g., a surveillance image).

**Verification**

The automated comparison of a facial image to a known standalone biometric sample, resulting in a computer-evaluated similarity score. This is commonly referred to as a 1:1 comparison.

**Vignetting**

A reduction in brightness and contrast towards the edges of an image.

**Verification**

(1) The final step of the ACE-V method; the review and independent analysis of the conclusion of another examiner. (2) In a biometric system, the process of conducting a one-to-one comparison.



**Yaw**

The rotation in degrees about the y-axis (vertical axis). Frontal poses have a yaw angle of zero degrees. Positive angles represent faces looking to their left (a counter-clockwise rotation around the y-axis). (ISO/IEC 19794-5).

**YUV422**

A color space standard used by many digital video cameras.

FISWG documents can be found at: [www.FISWG.org](http://www.FISWG.org)