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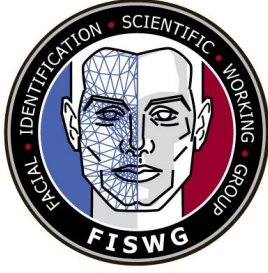
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Glossary

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

ACE-V
A scientific method of analysis, comparison, evaluation, and verification utilized in most comparative processes.

Ad Hoc Image
See *Uncontrolled Image*.

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.

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

Barrel Distortion
A type of lens distortion which is observed as 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.

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, mouth).

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

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

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.

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.

Doppelganger
An apparition or double of a living person.

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

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.

Eyebrows
Refers to the strips of hair above the eyes.

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

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

Face Recognition
(1) By humans, the cognitive process by which an observer identifies a person as being one they have seen before. (2) By automated systems, the automated searching of a facial image (probe) against a known collection typically resulting in a list of candidates ranked by computer-evaluated similarity score.

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

Face Matching
A type of face identification task requiring a perceptual decision whether two simultaneously presented faces (photo, video, live) depict the same person or different people.

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 Comparison
In facial identification, a manual process to identify similarities or dissimilarities between two (or more) facial images or facial image(s) and a live subject for the purpose of determining if they represent the same person or different person.

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)
The discipline of image-based comparisons of human facial features.

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 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).

False Match Rate (FMR)
Proportion of the completed biometric non-mated comparison trials that result in a false match. This will be referred to as FAR (false acceptance rate) and does not include errors from images which do not create valid templates.

False Non-Match Rate (FNMR)
Proportion of the completed biometric mated comparison trials that result in a false non-match. This will be referred to as FRR (false reject rate) and does not include errors from images which do not create valid templates.

Familiar Faces
Faces of people known to an observer.

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.

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

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

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).

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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, 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 horizonal lines of a video image.

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

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.

Identity
The collective set of biographic data, images, 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).

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.

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., JPEG).

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

Match/Matching
See *Identification*.

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

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.

Metadata
Non image-based information associated with an image file.

Mirroring
An image flipped in the horizontal plane.

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.

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.

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 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
A type of lens distortion which is observed as 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.

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.

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
A color gamut spectrum that stands for color channels <u>R</u>ed, <u>G</u>reen, and <u>B</u>lue.

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.

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

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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.

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
Standard default color space of red, green, blue 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 imaged 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.

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

Unfamiliar Faces
Faces of unknown or recently learned people.

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.

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

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.

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