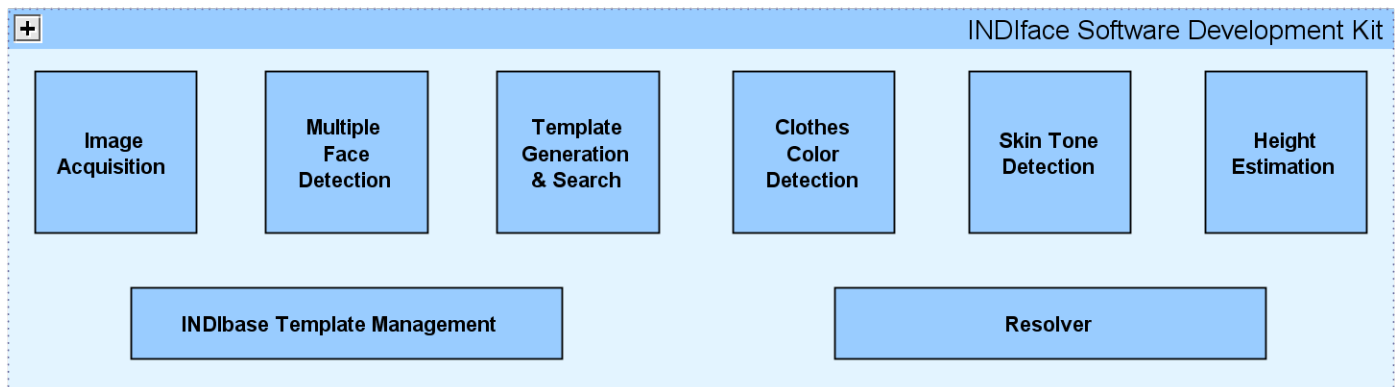


Eclipse Identity Recognition Corporation™ provides *Personal Identity Recognition* via its face-based analytics known as INDIface™. It is used to detect faces and facial features and then generate face templates for searching and matching. In addition, the INDIface analytics can also determine skin tone, upper and lower clothes color, and an estimated height of a person. The INDibase™ system provides for the enrollment, storage, management, retrieval, and matching of INDIface templates. INDibase also manages facial and other images as well as personal identification and characteristic data.

FusionIR™, the INDIface Software Development Kit (SDK), allows third-party developers to create custom applications using EclipseIR's technology. It runs on Microsoft Windows-based systems as a stand-alone console application with a capacity of 50,000 enrollments.



CONFIGURATION

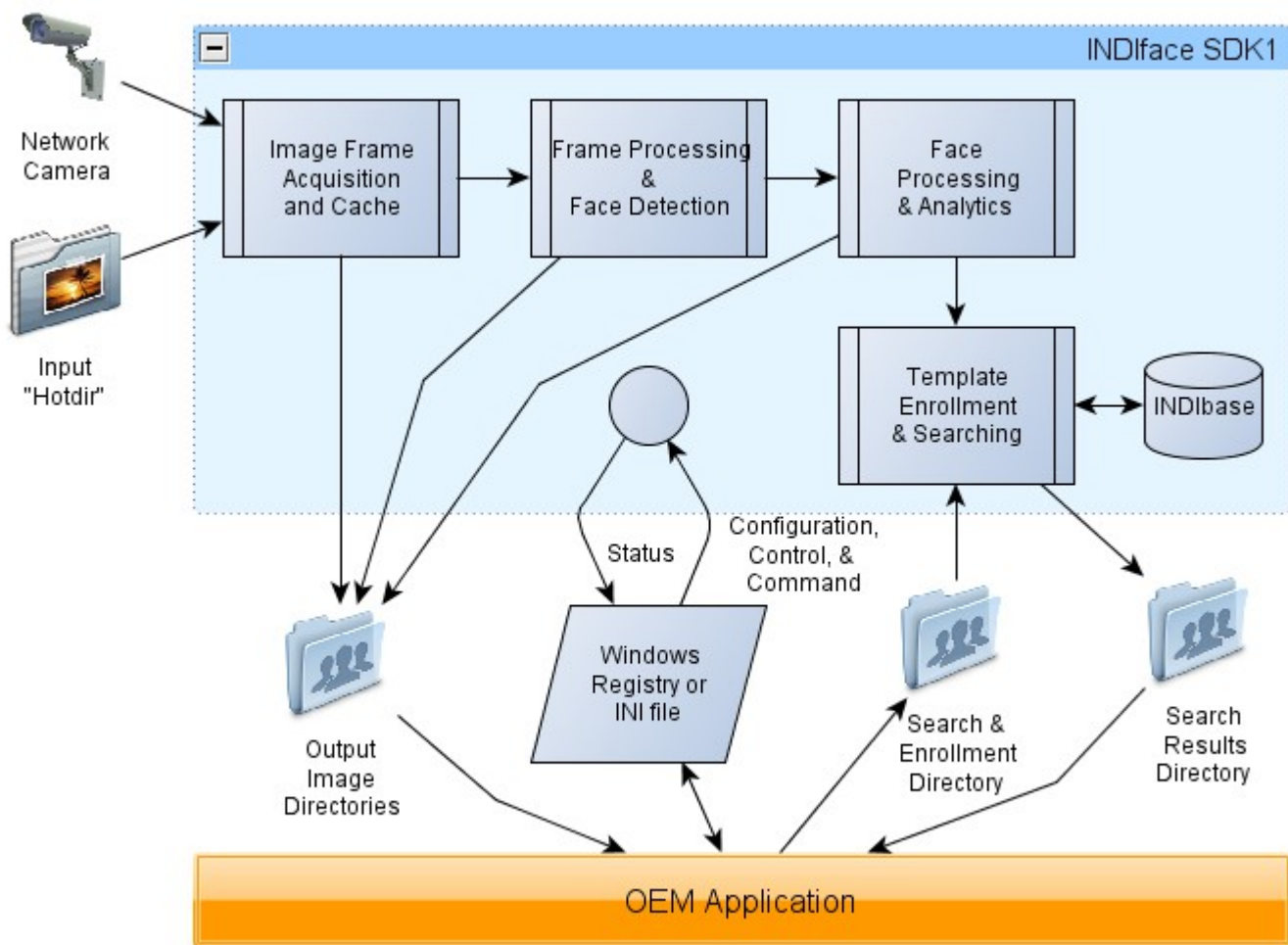
The behavior of the INDIface SDK is currently controlled via the Windows registry. Currently there are over 150 configurable values. Most of the configuration values are "volatile," that is they can be changed in the registry at any time and the executing console will automatically pick up the changes. Different registry base keys can be specified for different applications or uses.

INPUT

The INDIface SDK accepts single still images or sequences of frames, such as Motion JPEG. Image formats supported include BMP, PNG, and JPG. The image source can be a live IP camera or a "hot directory."

Live IP input expects an HTTP-scheme URL that will return a single frame. The SDK has been used with Axis 210-series cameras (and 240-series NTSC video encoders) and Arecont IP cameras. It should be compatible with ONVIF compliant cameras.

Stored images (whether individual stills or sequences) are processed from a "hot directory." Hot directories have several advantages: When all images have been processed, you can start processing again—mostly useful for testing or demonstrating. Images can be deleted from the directory after they have been processed. Image files can be moved to a separate directory after they have been processed. Processing can be started on an empty directory and image files are processed as they are dropped in to the "hot" directory.



PROCESSING STEPS

IMAGE PRE-PROCESSING & DETECTION

Once a single frame has been collected from an IP camera or hot directory, it is *preprocessed* and a *frontal face detector* is used to scan for candidate faces in the image. Each of the candidate faces is extracted from the original frame, optionally scaled and filtered, and a *face feature detector* is applied.

TEMPLATE GENERATION & CASUAL MATCHING

From the detected location of facial features the face image is “normalized” by aligning the eyes to fixed points. From the normalized image, an *INDIface template generation* will be performed. This template can be enabled for *casual matching* where a one-to-many search is executed against any active *INDIbase* enrollments.

ANALYTICS & RESOLVER

If the template generation process confirms a “qualified” human face, then other *analytic* data can be collected. The face position and size can be applied to calibration data for fixed camera positions to interpolate an estimated height of the person. The location of the upper and lower body can be determined and the characteristic color of those areas can be collected and compared against specified target colors. Representative areas of the face can be sampled to collect an average skin tone for comparison against multiple specified target colors.

The quality of the detected potential face, the consistency of the generated template, and the confidences of informal face match, upper and lower clothes color matches, height estimation, and skin tone match can then be fed to the *resolver*. The (positive or negative) weighted average of each of these factors can be combined to a resolved confidence value.

OUTPUT

Output data consists of frame images, cropped face images, normalized face images, and XML data files. The following table describes the various output categories.

Name	Data	Markings	Description
Capture	Frame	none	Raw capture image
Input	Frame	none	Preprocessed Input Image
Marked	Frame	head, eye, body	Marked input
NoFace	Frame	none	No potential faces detected
NoEyes	Crop	none	Potential face detected, but no eyes
BadFace	Norm	none	Eyes detected, but low consistency template
Face	Norm	none	Face and features detected
FaceCache	Norm	none	Ditto; number of files managed by console
Height	Frame	head	Height estimation matched

Name	Data	Markings	Description
Clothes	Frame	head	Upper and/or lower clothes color match
SkinColor	Frame	head	Matched one of the skin colors
Resolved	Frame	head	Resolved (original frame marked)
ResolvedFace	Norm	none	Resolved (face only)
XML	XML	n/a	XML data of frame, faces, and analytics
Match	Norm	none	Matching faces from INDIBase enrollments

Frame images and XML data files are identified by an *Image ID*. For frames captured from IP cameras, the image ID consists of a date stamp to the thousands of the second optionally prepended with a specified Camera ID. For images read from a directory, the image ID is the base file name. Cropped and normalized face image files are identified by a *Face ID*. The face ID consists of the image ID appended with the x,y coordinates of the position of the face in the original image and the quality and consistency values for the detected face. The output files are distributed to a set of directories specified in the configuration.

INDIBASE COMMANDS

The SDK console has three command modes to allow applications to interact with the active INDIBase enrollment.

ENROLL

In *Enroll mode*, an application can use the Enroll command to: ① Enroll new unidentified (not associated with a person) faces to the INDIBase. ② Create a new person and enroll faces for that person. ③ Add more faces to an existing person's enrollment. In addition the Delete command can: ① Delete an unidentified face from enrollment. ② Delete a specific face from a specified person's enrollment. And, the Remove command will remove a specified person and all enrolled faces for that person from the INDIBase. Further the RemoveAll command will remove all people and faces from the database.

RETRIEVE

In *Retrieve mode* and application can retrieve single enrollment images (from a specified person or unidentified) or all faces enrolled for a person.

SEARCH

In *Search mode*, and application can submit faces to be searched against the current INDIBase enrollment. ① With the Verify command, the submitted faces are compared to a specified person and a single confidence level is returned. ② With the Search command the submitted faces are compared to the entire INDIBase enrollment. The results are a list of the best matching faces sorted by confidence. In *Person Search Mode*, results for the same enrolled person are grouped together. With both the formal search and casual match above, results are separated into tiers: Best, Strong, Possible, and Weak.