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Face identification for surveillance systems

VeriLook Surveillance SDK

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Face identification for video surveillance systems

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CONTENTS

VeriLook Surveillance SDK is intended for developing biometric software that performs face identification using live video streams from high-resolution digital surveillance cameras. The SDK is based on VeriLook facial recognition technology and is used for **passive biometric identification** – when passers-by do not make any efforts to be recognized. List of possible uses includes law enforcement, security, attendance control, visitor counting and other commercial applications.

The VeriLook Surveillance SDK allows to create applications for Microsoft Windows and Linux platforms.

- Real time face detection, template extraction and matching against watchlist database.
- Simultaneous multiple face tracking in live video.
- Automatic operation allows to log and report face appearance, match and dissapearance events, as well as to enroll new faces from video stream and add them to watchlist automatically.
- Large surveillance systems support by connecting several cameras to a computer and quick synchronization between networked computers.
- Available as multiplatform SDK that supports multiple programming languages.
- Reasonable prices, flexible licensing and free customer support.

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VeriLook Surveillance Technology Features and Capabilities

VeriLook Surveillance 2.1 technology extends the VeriLook face recognition algorithm for working with surveillance cameras. The VeriLook Surveillance 2.1 has these specific capabilities:

- **Real time performance.** Verilook Surveillance technology performs face detection, features extraction and template matching with the internal database in real time. The technology is designed to run on multi-core processors to achieve fast performance.
- **Multiple face tracking**. Once detected, the faces are tracked in all successive frames from the video source until they disappear from camera field of view. The tracking algorithm uses dynamic face and motion prediction models that make it **robust to occlusions** like other objects or even other faces. The algorithm is able to continue tracking a face even when it re-appears after being fully covered by occlusions (like walls, furniture, posters etc).
- **Automatic operation.** A system based on VeriLook Surveillance 2.1 SDK is able to log face appearance, disappearance and tracking. The detected faces are matched against the watchlist in the internal database and recognized faces are immediately reported to the system. The system uses face tracking for automatic enrollment from video stream and adding new facial templates to watch list on the fly.
- **Large surveillance systems support.** VeriLook Surveillance 2.1 SDK allows to integrate its technology into surveillance systems with **multiple cameras** and **multiple data-processing nodes**. A single PC or server can process video data from several cameras simultaneously. Multiple PCs with running VeriLook Surveillance software can **quickly synchronize** biometric and surveillance data between each other over the network. The synchronization can be **customized** as the SDK includes sample source code for using the communication and synchronization processes.
- **Video files processing.** VeriLook Surveillance also accepts data from video files. The video files are processed in real time as coming from a virtual camera, therefore a hour-long video will be processed in one hour.

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VeriLook Surveillance 2.1 SDK components

VeriLook Surveillance 2.1 SDK is based on the VeriLook Surveillance 2.1 technology that is specially designed for integrating biometric facial recognition into video surveillance systems. Face templates created with VeriLook Surveillance SDK are fully compatible with VeriLook SDK and MegaMatcher SDK multi-biometric technology.

VeriLook Surveillance 2.1 SDK includes Device Manager library for Microsoft Windows and Linux that allows to perform **simultaneous capture from multiple cameras.**

Components	Microsoft Windows (32 & 64 bit)	Linux (32 & 64 bit)
• VeriLook Surveillance 2.1 component	1 single computer license	
• Device manager library	+	+
Programming tutorials		
• C++	+	+
• C#	+	
• Visual Basic .NET	+	
Programming tutorials		
• C	+	+
• C#	+	
Documentation		
• VeriLook Surveillance 2.1 SDK documentation	+	

VeriLook Surveillance Component

The VeriLook Surveillance Component performs real-time detection and tracking of all detected faces from live video stream. The component is able to track multiple faces simultaneously and match them with faces from internal database (i.e. a watch-list of suspects or a list of company employees).

New faces may be enrolled to the database either automatically or manually from **image files**. The **C# and VB .NET samples** from the SDK shows how to enroll new faces from image files.

VeriLook Surveillance 2.1 components can be run on multiple PCs distributed over network and **synchronize** data between themselves. The **C# and VB .NET samples** from the SDK shows how to call the synchronization routines.

Device Manager library

Device Manager library works under Microsoft Windows and Linux and provides functionality for working with cameras. The library supports a range of high-resolution digital surveillance cameras and other cameras that provide DirectShow interface for Windows platform, or GStreamer interface for Linux platform.

The list of supported cameras is available below in the “System Requirements” section.

The Device Manager includes a plug-in framework that allows integrators to **write plug-ins to support their cameras** using the provided API. The VeriLook Surveillance SDK documentation contains the detailed information and samples.

A **video file** can be also used as a data source for VeriLook Surveillance. The input from the file is processed as coming from a virtual camera, thus the video is processed in real-time.

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Basic Recommendations for VeriLook Surveillance Usage

Face recognition accuracy of VeriLook Surveillance heavily depends on the quality of a face image. **Image quality during enrollment is important**, as it influences the quality of the face template.

There are some basic recommendations and constraints when using face recognition applications based on VeriLook Surveillance SDK.

Cameras and images

- **Similar quality cameras** are recommended for both enrollment and identification. Using the same camera model is even better. Enrollment from **photo** is also possible if it conforms to other requirements on this page.
- **40 pixels is the recommended minimal distance between eyes** for a face on image or video stream to perform face template extraction. **75 pixels or more** recommended for better face recognition results. Note that this distance should be **native**, not achieved by resizing an image.
- **1 MegaPixel** or better camera resolution is recommended for face enrollment and recognition. Make sure that **native** resolution is provided by a camera, as some cameras or webcams may **scale up** native images to higher resolution without image quality improvement.
- **Check for mirrored face images**, as recognition will fail if a face was enrolled from a mirrored image, and later a non-mirrored face image is used for recognition (or vice versa). This happens as some cameras can be configured to produce mirrored images or may even produce them by default, and different cameras or configurations may be used during enrollment and identification. We recommend to use face images with uniform orientation – all images within a system should be either native or mirrored, but not mixed between each other.
- **Use several images during enrollment**, as it improves facial template quality which results in improvement of recognition quality and reliability.

Lightning

Controlled lighting conditions are recommended:

- **Direct frontal or diffused light** allows equal lighting distribution on each side of the face and from top to bottom with no significant shadows within the face region.
- **Avoid glares** on face skin or glasses that are produced by some types of illumination.

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Face posture

The VeriLook Surveillance face recognition engine has certain tolerance to face posture:

- head **roll** (tilt) – ±180 degrees (configurable).
  - **±15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
- head **pitch** (nod) – ±15 degrees from frontal position.
  - The head pitch tolerance can be increased up to ±25 degrees if several views of the same face that covered different pitch angles were used during enrollment.
- head **yaw** (bobble) – ±45 degrees from frontal position (configurable).
  - **±15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
  - **30 degrees difference** between a face template in a database and a face image from camera is **acceptable**.
  - Several views of the same face can be enrolled to the database to cover the whole ±45 degrees yaw range from frontal position.

Face quality recommendations for enrollment

- **Neutral face expression** during enrollment is recommended, as non-neutral face expression may affect the accuracy of recognition.
- **Several images with different appearance variants** are recommended for enrollment to assure the quality of recognition in the situations when part of face is covered with glasses or hair:
  - **Eyeglasses** – separate enrollments with and without glasses will assure the best recognition quality for both cases.
  - **Hair style** – some hair styles may cover parts of face, thus **hairpins** or other means of holding hair off the face are recommended during enrollment.
  - **Facial hair** style changes may require additional enrollments, especially when beard or moustache is grown or shaved off.

Memory and Performance Constraints During Face Tracking

- **Memory usage.** VeriLook Surveillance consumes about **10 MB of memory per minute** when tracking one face at a speed of 10 frames per second. The consumed memory is released after the face disappears from a frame.
- **Multiple faces in a frame.** If multiple faces are visible in a frame, tracking performance falls down.
- **Minimal frame rate.** It is recommended to retrieve at least **10 frames per second** from a camera. If less than 10 frames are captured, face tracking feature may be not available.

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System requirements

- At least **Intel Core 2** CPU with **4 cores** running at **2.66 GHz** or equivalent multi-core processor from other manufacturer.
  - At least **2 processor cores** are required to process surveillance data from **one camera** with several faces in a frame. If there are more than 2 cameras in a surveillance system, several networked PCs or a multi-processor server will be required to process data from the cameras.
  - If **large number of faces in a frame** is expected, more processor cores, more powerful processor or even multi-processor server may be required to process surveillance data and keep the acceptable performance.
- At least **1 GB** of free RAM
- A **high-resolution digital camera**. The camera resolution may vary depending on the actual application. The recommended resolution is about 1 Megapixel, as processing video from cameras with higher resolution will require more free RAM and more powerful processor to keep the acceptable frame rate.
  These supported cameras are suitable for using with VeriLook Surveillance 2.1 SDK:
  - **Axis M1114** camera (Microsoft Windows and Linux)
  - **Cisco 4500 IP** camera (Microsoft Windows only)
  - **Mobotix DualNight M12 IP** camera (Microsoft Windows and Linux)
  - **PiXORD N606** camera (Microsoft Windows and Linux)
  - **Prosilica GigE Vision** camera (Microsoft Windows and Linux)
  - **Sony SNC-CS50** camera (Microsoft Windows and Linux)
  - Any other high-resolution digital camera that is accessible using:
    - **DirectShow** interface for Microsoft Windows platform
    - **GStreamer** interface for Linux platform.

  Any **other device support can be added by customers** using the provided Device Manager **plug-in framework**. Please refer to the VeriLook Surveillance 2.1 SDK documentation for the detailed information.
- Microsoft Windows specific:
  - Microsoft Windows XP / Vista / 7 / Server 2003 / Server 2008
  - Microsoft DirectX 9.0 or later
  - Microsoft .NET Framework 2.0 or later
- Linux specific:
  - Linux 2.6 or newer kernel, 32-bit or 64-bit.
  - glibc 2.7 or newer
  - GStreamer 0.10.23 (with gst-plugin-base and gst-plugin-good) or newer (for face capture using camera/webcam)
  - udev-143 or newer with libudev (for camera usage)
  - GTK+ 2.10.x or newer libs and dev packages (to run SDK samples and applications based on them)
  - GCC-4.0.x or newer (for application development)
  - GNU Make 3.81 or newer (for application development)

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Technical Specifications

The specifications are provided for the default values of the parameters.

640 x 480 pixels is the recommended minimal frame size for faces' detection. Face template extraction and matching with watchlist database speeds are not dependent on the frame size.

40 pixels is the **minimal distance between eyes** for a face on video stream or image to perform face tracking and template extraction.

Face **tracking performance** is dependent on actual **size of a face** in a frame, not on the size of the whole frame.

VeriLook Surveillance has certain tolerance to face posture that assures face detection and tracking:

- head **roll** (tilt) – ±180 degrees (configurable).
  - **±15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
- head **pitch** (nod) – ±15 degrees from frontal position.
  - The head pitch tolerance can be increased up to ±25 degrees if several views of the same face that covered different pitch angles were used during enrollment.
- head **yaw** (bobble) – ±45 degrees from frontal position (configurable).
  - **±15 degrees default** value is the fastest setting which is usually sufficient for most near-frontal face images.
  - **30 degrees difference** between a face template in a database and a face image from camera is **acceptable**.
  - Several views of the same face can be enrolled to the database to cover the whole ±45 degrees yaw range from frontal position.

See above the whole list of recommendations and constraints for VeriLook Surveillance usage.

20 kilobytes default facial template size is enough to provide required performance and accuracy of the facial recognition algorithm. Other available template sizes are 4 kilobytes and 36 kilobytes. See the VeriLook algorithm reliability and performance tests below for more information on the algorithm performance with the other template sizes.

At least **2 processor cores** are required to process surveillance data from **one camera** with moderate number of faces in a frame. A PC, which has a processor with 4 cores, can be used to process data from 2 cameras almost without performance decrease. If large number of faces in a frame is expected, data processing will require to utilize more processor cores or to use more powerful processor.

Performance specifications are provided for these processors:

- Intel **Core 2 Q9400** (4 cores), running at **2.67 GHz** clock rate;
- Intel **Core i7-2600** (4 cores), running at **3.4 GHz** clock rate.

VeriLook Surveillance 2.1 algorithm technical specifications		
	Intel Core 2 Q9400	**Intel Core i7-2600**
Frame rate when tracking up to 3 faces	More than 15 frames per second	More than 20 frames per second
Frame rate when tracking up to 5 faces	More than 10 frames per second	More than 14 frames per second
Watch-list database matching time (1)	Less than 1 second	Less than 0.5 second
Maximum watch-list database size	Limited by amount of **free RAM**	

(1) up to 30,000 records in the database; larger database yelds slower response time. Note that each person may be represented by several records in the database with different appearance variations, different capture angles etc.

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VeriLook Surveillance SDK Trial, Algorithm Demo and Related Products

VeriLook Surveilllance **30-day SDK Trial** and **algorithm demo** applications are available for downloading at ***www.neurotechnology.com/download.html***.

These products are related to VeriLook Surveillance SDK:

- **VeriLook SDK** - a software development kit that allows development of PC- and Web-based solutions on Microsoft Windows, Linux and Mac OS X platforms. See “VeriLook SDK” brochure for more information.
- **MegaMatcher SDK** – intended for development of AFIS or multi-biometric face, fingerprint, iris and palm print identification products. See “MegaMatcher SDK” brochure for more information.

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Licensing VeriLook Surveillance SDK

The following licensing model is intended for **end-user** product developers. Integrators who want to develop and sell a VeriLook Surveillance based development tool (with API, programming possibilities, programming samples, etc.), must obtain permission from Neurotechnology and sign a special VAR agreement.

Product Development

An integrator should obtain a VeriLook Surveillance 2.1 SDK (EUR 790) to develop a product based on VeriLook Surveillance technology. The SDK needs to be purchased just once and may be used by all the developers within the integrator's company.

VeriLook Surveillance 2.1 SDK includes VeriLook Surveillance component. A **license** for an individual VeriLook Surveillance component is required for **each CPU** that **runs** the component (a processor can have any number of cores).

One single computer license for the VeriLook Surveillance component is included with VeriLook Surveillance 2.1 SDK.

Components are copy-protected – a license is required for a component to run. License activation options are listed below.

Additional component licenses may be obtained by VeriLook Surveillance SDK customers as required by their development process.

Product Deployment

To deploy a product developed with VeriLook Surveillance SDK, an integrator need obtain only the additional licenses required for the VeriLook Surveillance components that will run on **each CPU** of their customer's computers. The available license types for product deployment are the same as for product development.

Each VeriLook Surveillance component running on a computer belonging to the integrator's customer requires a license. License activation options are listed below.

Prices for VeriLook Surveillance 2.1 SDK and additional VeriLook Surveillance component licenses can be found in the next chapter.

Please also refer to *VeriLook Surveillance SDK Software License Agreement* at Neurotechnology web site for all licensing terms and conditions.

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Single computer licenses

A single computer license allows the installation and running of a VeriLook Surveillance component installation on one CPU (a processor can have any number of cores). Neurotechnology provides a way to renew the license if the computer undergoes changes due to technical maintenance.

Each single computer license requires **activation** for a VeriLook Surveillance component to run. The available activation options are listed below.

Additional single computer licenses for VeriLook Surveillance components may be obtained at any time by VeriLook Surveillance SDK customers.

License activation options

Single computer and concurrent network licenses are supplied in two ways:

- **Serial numbers** are used to activate licenses for VeriLook Surveillance components. The activation is done via the Internet or by email. After activation the network connection is not required for single computer license usage. Note: activation by serial number is not suitable for virtual environments.
- Licenses may be stored in a volume license manager **dongle**. License activation using volume license manager may be performed without connection to the Internet and is suitable for virtual environments.

Volume license manager

Volume license manager is **used on site by integrators or end users** to manage licenses for VeriLook Surveillance components. It consists of license management software and a dongle, used to store the purchased licenses. An integrator or an end-user may use the volume license manager in the following ways:

- **Activating single computer licenses** – An installation license for a VeriLook Surveillance component will be activated for use on a particular computer. The number of available licenses in the license manager will be decreased by the number of activated licenses.
- **Managing single computer via a LAN or the Internet** – The license manager allows the management of installation licenses for VeriLook Surveillance components across multiple computers in a LAN or over the Internet. The number of managed licenses is limited by the number of licenses in the license manager. No license activation is required and the license quantity is not decreased. Once issued, the license is assigned to a specific computer on the network.
- **Using license manager as a dongle** – A volume license manager containing at least one license for a VeriLook Surveillance component may be used as a dongle, allowing the VeriLook Surveillance component to run on the particular computer where the dongle is attached.

Additional VeriLook Surveillance component licenses for the license manager may be purchased at any time. Neurotechnology will generate an update code and send it to you. Simply enter the code into the license manager to add the purchased licenses.

VeriLook Surveillance enterprise license

The VeriLook Surveillance enterprise license allows an unlimited use of VeriLook Surveillance components in end-user products for a specific territory, market segment or project. Specific restrictions would be included in the licensing agreement.

For more information please contact us.

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Prices for VeriLook Surveillance SDK

- The prices are **effective from April 2, 2012**. The prices may change in the future, so please **download and review the latest version** of the brochure before making an order.
- Quantity discounts do not accumulate over time.
- The prices do not include any local import duties or taxes.
- Product shipping cost depends on delivery country
- Our customers can gain a discount for our products by getting the Solution Partner status.

VeriLook Surveillance SDK

VeriLook Surveillance 2.1 SDK	€ 790.00

VeriLook Surveillance 2.1 installation licenses (prices per single computer license)

Quantity	Price per unit
1-9	€ 270.00
10-19	€ 200.00
20-49	€ 180.00
50-99	€ 155.00
100-199	€ 140.00
200-499	€ 125.00
500-999	€ 110.00
1000-1999	€ 99.00
2000-3999	€ 88.00
4000-7999	€ 79.00
8000 and more	Please contact us for more information

License management

Volume license manager	€ 16.00

VeriLook Surveillance SDK enterprise license

VeriLook Surveillance 2.1 SDK enterprise license	Please contact us for more information

VeriLook Surveillance SDK and related products can be ordered:

- online, at ***www.neurotechnology.com/cgi-bin/order.cgi***
- via a local Neurotechnology distributor; the list of distributors is available at ***www.neurotechnology.com/distributors.html***

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