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## 1. TechnoAware - Your Video Analysis Partner

TechnoAware researches and develops own technologies, products and solutions for video analysis and Artificial Intelligence.

Founded in 2003 from the University of Genoa's ISIP40 Research Group, with more than 35 years of experience, competence and know how TechnoAware's Team is one of the foremost experts worldwide in video analysis and Artificial Intelligence.



TechnoAware offers its products and services worldwide, by a network of more than 50 among local and global official distributors.

HQ in Genoa, Italy  
**11** international offices  
**50+** Commercial Partners  
**400+** Certified Integrators Partners  
 Presence in **125** Countries



### 1.1. Why Video Analysis?

In the world there are now hundreds of millions of cameras, mainly for video surveillance.

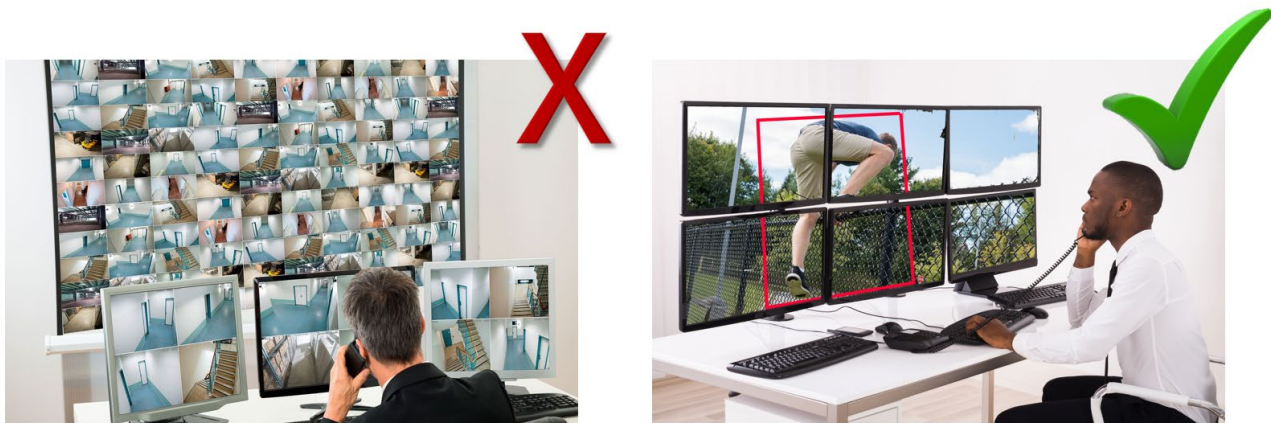
However, the amount of human personnel involved in monitoring and managing video surveillance has grown relatively very little, in comparison, resulting in an average range of 25 to 70 cameras being monitored by each operator.

Recent studies and research have shown that human observers of video systems start showing signs of fatigue in as little as 12 minutes, overlooking up to 45% of activity in the camera scenes. After 22 minutes, the amount of overlooked activity increases up to 95%. It is then physiologically impossible

for a human operator to monitor even a single screen with timely effectiveness and for a long time, which can lead to a higher probability of missing critical events.

The result is that the cameras, in most cases, become useful only at the level of post-analysis once the event of interest has already taken place and the related eventual damages have already been caused.

Artificial-Intelligence-based video analysis allows video surveillance cameras to be analyzed simultaneously and in real time 24/365, without loss in the level of attention, for immediately detecting and notifying events of interest to a human operator. This allows to verify and react simultaneously with the event and to reduce or even to avoid its negative effects.



Video analysis therefore makes it possible to increase extraordinarily the effectiveness and the efficiency of video surveillance systems, drastically reducing the costs of its management; thus, creating a strongly increased business value by delivering more specific and targeted information.

## 1.2. Why TechnoAware?

- the largest and most complete video analysis offer
- more than 35 years of experience, specific competence and know-how
- continuous investments in R&D, for the most up-to-date and performing algorithms
- integrated with all the major market leading brands of VMS and cameras
- hardware independent software-based products
- availability of server-based or edge-based products
- presence worldwide
- efficient and always available technical and commercial support
- training and certification programs for channel partners
- aggressive pricing policy and clear go-to-market structure

## 2. VTrack - Video Analysis for intelligent video surveillance

Born from the results of more than 35 years of research activities, VTrack is the most complete suite of Video Analysis functions. Constantly up to date with the scientific state of the art, VTrack always integrates all the latest video analysis algorithms and methods for the most performing and reliable intelligent video surveillance solutions.



### 2.1. VTrack - Available functions



#### Intrusion

Detection and notification of the intrusion within virtual areas or the crossing of virtual lines by targets of interest



#### GateFlow

Counting and collection of the number of persons crossing virtual gates in a certain direction



#### AreaCounting

Counting and collection of the number and the dwell time of targets of interest inside virtual areas, and for each area notification of the presence of the number of targets of interest equal to or higher/lower than a defined threshold



#### OccupancyRate

Estimation and collection of the percentage of occupancy within virtual areas by targets of interest, and for each area notification of an occupancy percentage higher than a defined threshold



#### HotZones

Estimation and visualization in false colors on the image and on a map of the zones with higher or lower presence of persons within a defined timeframe inside virtual areas

**ATM**

Detection and notification of one or more than one person remaining within a virtual area for longer than a defined time

**LeftObject**

Detection and notification of objects left unattended within virtual areas for longer than a defined time

**StolenObject**

Detection and notification of objects removed from virtual areas

**Loitering**

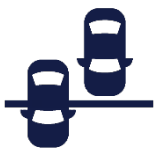
Detection and notification of targets of interest remaining within virtual areas for longer than a defined time

**PanicDisorder**

Detection of sudden or anomalous variation of speed and/or acceleration of targets of interest within virtual areas

**SlipFall**

Detection and notification of a person falling and remaining on the ground for longer than a defined time

**Counting**

Counting and collection of the number of targets of interest crossing virtual gates in a certain direction

**AvSpeed**

Estimation and collection of the average speed of targets of interest, and notification of average speed exceeding or below a defined threshold

**StationaryVehicle**

Detection and notification of vehicles, stationary within virtual areas for longer than a defined time

**WrongWay**

Detection and notification of targets of interest moving toward a not allowed direction within virtual areas

**SmokeFire**

Detection and notification of smoke and/or fire within virtual areas



### FaceDetection

Detection and notification of the presence of human faces within virtual areas and, for each detected face, collection of its permanence time



### LPR

Detection, real time automatic reading and notification of vehicles' license plates for access control management



### SkimmerDetection

Detection and notification of the presence of minimal variations of the position of contours within a virtual area (ATM)



### ParkingLot

Detection and notification of the status (free/occupied) of configured parking areas



### LackRefill

Detection and notification of the lack of objects inside a configured area (i.e. basket, shelf, trolley area, ...), below a defined occupancy threshold



### Thermal

Detection and notification of targets of interest within a defined temperature range inside a configured virtual area, by processing thermometric cameras



### LightOn

Detection and notification of the status of a light (on/off)



### PTZStandAlone

Detection, notification and tracking of targets of interest by processing a Pan/Tilt/Zoom camera



### PTZPlugIn

Automatic piloting of a Pan/Tilt/Zoom camera for tracking a target of interest alarmed by a VTrack function processing one or more connected fixed cameras



### Custom

Development of a custom function based on specific requirements

## 2.2. General specifications

### 2.2.1. System architecture

- Modular and hardware-independent software architecture, available for Windows o.s.
- Acquisition sources:
  - video stream from IP cameras (optical or thermal), compatible with standard protocols rtp/rtsp, mjpeg or ONVIF
  - video stream from analogue cameras (optical or thermal), through video encoders or hybrid NVR/DVR compatible with standard protocols rtp/rtsp, mjpeg or ONVIF
  - video stream from compatible VMS/DVR/NVR platforms
  - off-line videos in all standard formats (avi, asf, mpg, mov, ...)
  - single images in jpeg format
- Automatic and real time alarm notifications to:
  - TechnoAware-CentralManager client, local or remote
  - compatible VMS/DVR/NVR platforms
  - I/O contacts through Modbus protocol
  - network http or TCP notification, customizable
  - e-mail, with in attachment the image related to the generated alarm
  - FTP client, saving the video clip related to the generated alarm
- Real time or off-line data fruition (events, counting, plates, other data) by:
  - VTrack WebInterface
  - external cgi call, for receiving automatically an xml file through http with the required data
  - automatic periodical report in pdf format, customizable by project
- Enabling/disabling of the modules by:
  - an interrupt from an external input, through cgi call
  - the polling of the status of an external I/O contact, through http or TCP call
  - time scheduling, by timetabled configuration
  - manually, by VTrack-CentralManager client
- Ability to stream out, by rtsp protocol, the real time processed video flow with the overlays of targets' bounding boxes and trajectories for being acquired by compatible third-party platform

### 2.2.2. Video analysis' engine features

- Based on the most advanced self-adaptive algorithms based on Self Learning Background Modeling and Multi-target Tracking, for the most robust and reliable performances in any environmental conditions (atmospheric phenomena, vegetation, changing of lights, ...)
- Gradient-based low-level algorithm, for the extraction of the contours of the scene

- Availability of Deep Learning based modules for advanced detection and classification of specific targets
- Detection and tracking of unlimited targets in the scene
- Morphological Filter, for improving the efficiency of targets detection and/or separation by shape enhancement
- Foreground Filter, for the image stabilization and for the limitation of heavy dynamic background noise (e.g. dense vegetation, heavy rain, clouds, ...), selective on specific configurable areas
- Specific algorithms for filtering shadows and light changes
- Adaptive pre-filtering for the limitation of heavy noise
- Adaptive gamma-correction algorithms for the enhancement of the image contrast
- Automatic dynamic adjustment of the contrast sensitiveness, according to the environmental changes
- 3D perspective management, by linear interpolation on image, or by image calibration
- Ability to configure different perspective plans according to the scenario morphology

### **2.2.3. Modules' configuration features**

- Ability to set up unlimited cameras and parameters configurations, according to timetabled or manual scheduling
- Ability to import/export a configuration database previously set up
- Unlimited configurable independent active zones, of any shape and size
- For each configured active zone, ability to configure independent alarm notifications for:
  - start of alarm condition
  - end of alarm condition
- For each configured active zone, ability to configure an absence alarm notification in case of no alarm event occurred within a defined timeframe
- Ability to crop and process independently unlimited image portions of the acquired video flow
- Unlimited configurable no-processing areas, to inhibit not-of-interest areas in the image
- Unlimited configurable no-initialization areas, to filter the targets initialized where no targets of interest are expected to appear
- Filtering of targets by size, area and dynamics
- For each configured active zone, ability to select specific active points of the detected target
- For each configured active zone, ability to filter targets by size and/or color
- Ability to manage different configurations for different configured presets of a PTZ camera
- Ability to process the acquired video flow at a lower resolution and frame rate
- VirtualAlertRule function, for the generation of alarms by correlating in AND within a certain time the occurring of multiple alarms configured on the same camera or on other cameras connected locally



- PrivacyBlur function, for the streaming of the video flow with the detected targets blurred in accordance with the privacy law

#### **2.2.4. *TechnoAware-CentralManager Client***

- Centralized configuration of unlimited local and/or remote VTrack modules
- Automatic detection of all VTrack servers connected in the same sub-network
- Centralized live view of the connected local and/or remote VTrack modules
- Centralized real time visualization and management of the alarms and data, notified by unlimited connected local and/or remote VTrack modules
- Real time or off-line simulation of the processing results, to verify the correctness of the configuration
- Visualization of the bounding box and trajectories of the detected targets, either in the live view and in the alarms panel
- Real time visualization of the detected targets trajectories on a calibrated map
- Recording and storing in local directories of continuous or event-based video clips
- Centralized configuration of different user levels, allowing or inhibiting for each one of them the access to specific areas of the module
- Ability to generate reports of the alarm events occurred or the data collected (counting, speed, occupancy, license plates, ...) in a defined timeframe by a specific configured function, in PDF format

#### **2.2.5. *VTrack-WebInterface***

- Real time visualization of the current data (counting, speed, occupancy, license plates, ...) related to the specific configured function, numerical and graphical
- Interrogation and visualization of the stored data related to the specific configured function in a certain timeframe, numerical and graphical
- Ability to export of the stored data in csv format
- Ability to make a manual reset of the visualized counting data

#### **2.2.6. *Diagnostics***

- Watchdog function, for the automatic restart of the module in case of critical error or eventual restart of the hardware unit
- HeartBeat function, for the periodical notification of the correct working of the module to an external device
- Ability to check the status of the active configuration by html/xml request, or by using the relative view in the TechnoAware-CentralManager

- Tampering function, to trigger an alarm on detection of camera obscured, dazzled or moved for longer than a configured time
- QualityCam function, to trigger an alarm on the reduction of visibility of the camera (i.e. because of dirt)
- VideoLoss function, to trigger an alarm on the loss of the video flow communication to the module
- VTrack-Monitor Client, for the configuration of automatic notifications for malfunctioning events of the connected VTrack modules

### **2.2.7. Licensing**

- Licensing per each video flow current configuration, according to the number of functions working in parallel, regardless of the specific function (unless for Special Packages)
- License bound to the processing server unit, not bound to the video stream device (camera, encoder, ...)
- No server licenses need, no added plug-in licenses needed
- Local or remote VTrack license management through TechnoAware-CentralManager client
- Full availability of failover license management

## **2.3. Technical requirements**

### **2.3.1. Image and video streaming requirements**

- Conditions of the target in the image for maximizing the detection performances:
  - clearly visible to the naked eye in the image, even in difficult environmental conditions (night, heavy rain, snow, fog, sun glare, reflections, artificial lights, under/overexposed camera, obstacles, ...)
  - entirely visible in the image for at least 10-15 continuous frames
  - minimum size: area of 100 pixels, at the farthest point where the detection is required (i.e. 5x20 pixel for a person)
- Minimum frame rate: 10 fps
- Suggested image resolution: according with the target's minimum size requirement, as per above.

### **2.3.2. Processing unit's requirements**

- Processor type: AVX compatible
- Computational need:
  - CPU: considering, as reference, a single core with 2,8GHz base speed

- up to 8 functions in parallel, processing video flows in QVGA resolution (320x240) at 10 frames per second
- up to 6 functions in parallel, processing video flows in CIF resolution (352x288) at 10 frames per second
- up to 3 functions in parallel processing video flows in VGA resolution (640x480) at 10 frames per second
- up to 2 functions in parallel processing video flows in 4CIF resolution (704x576) at 10 frames per second
- up to 2 functions in parallel processing video flows in 800x600 resolution at 8 frames per second
- up to 1 function processing video flows in FullHD (1080p) resolution (1920x1080) at 5 frames per second
- RAM: about 80MB for each function processed in parallel
- GPU (only in case of use of Deep-Learning-based modules):
  - NVIDIA CUDA compatible
  - RAM DDR5 or superior
  - 0,2GB GPU RAM for each video stream processed
- Supported OS: Windows 8 or later

### 3. TFace - Video Analysis for biometric face recognition

TFace-Recognition is a Biometric Artificial Intelligence based video analysis application for identifying or verifying uniquely a person, by comparing its facial features detected from digital images or video frames with faces within a database.



#### 3.1. Technical Specifications

##### 3.1.1. General architecture

- Modular and hardware-independent software architecture, available for Windows o.s.
- Acquisition sources:
  - video stream from IP cameras (optical or thermal), compatible with standard protocols rtp/rtsp, mjpeg or ONVIF
  - video stream from analogue cameras (optical or thermal), through video encoders or hybrid NVR/DVR compatible with standard protocols rtp/rtsp, mjpeg or ONVIF
  - video stream from compatible VMS/DVR/NVR platforms
  - off-line videos in all standard formats (avi, asf, mpg, mov, ...)
  - single images in jpeg format
- Automatic and real time alarm notifications to:
  - TechnoAware-CentralManager client, local or remote
  - compatible VMS/DVR/NVR platforms
  - I/O contacts through Modbus protocol
  - network http or TCP notification, customizable
  - e-mail, with in attachment the image related to the generated alarm

- FTP client, saving the video clip related to the generated alarm
- Ability to configure real time alarm notifications in case of:
  - Person recognized among a configured group of persons stored in the database
  - Person recognized, but not present in any of the configured groups of persons in the database
  - Person unknown
- Ability to detect and recognize more faces present in the provided images at the same time

### **3.1.2. Enrollment**

- Enrollment of the face templates and images through:
  - Real time acquisition from camera device
  - Import of faces images and data coming from external databases (i.e. police mugshots, personnel archives - by project)
  - Manual entry of images or off-line videos
- Identity data editing by:
  - Manual entry
  - Data import from external databases (by project)
- Ability to detect and recognize more faces present in the provided images at the same time

## **3.2. Technical requirements**

### **3.2.1. Image and video streaming requirements**

- Conditions of the face in the image for maximizing the identification performances:
  - clearly visible to the naked eye in the image, even in difficult environmental conditions (night, heavy rain, snow, fog, sun glare, reflections, artificial lights, under/overexposed camera, obstacles, ...)
  - with a resolution that guarantees at least 80 pixels eye-to-eye at the point where the face is meant to be identified
  - with an angle of radial inclination in respect with the camera not larger than 20°-25°
  - entirely visible in the image in the above indicated conditions for at least 10-15 continuous frames

### **3.2.2. Processing unit's requirements**

- Processor type: AVX compatible
- Supported OS: Windows 8 or later

- Computational need:
  - CPU: about 200k comparisons/second, with a single core 3,2GHz
  - RAM: 9kB per enrolled template