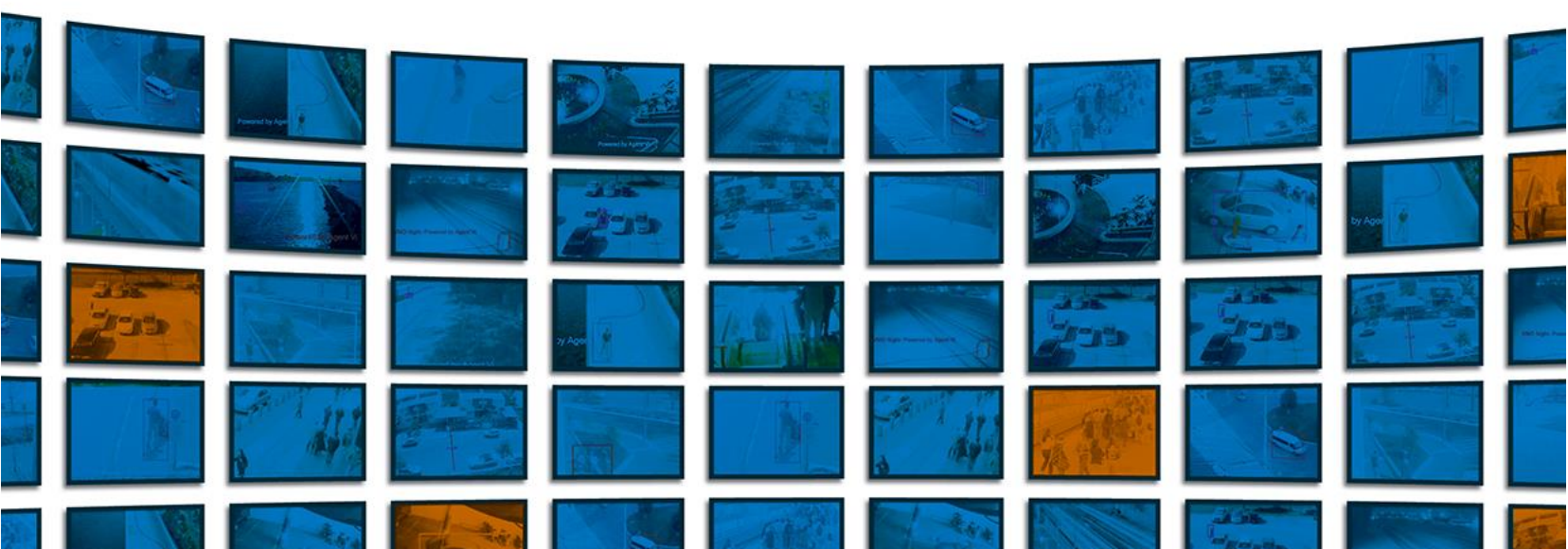




Comprehensive Video Analytics Solutions

A&E (Architecture & Engineering) Specification for a Video Analytics Solution



1 Analytics Requirements

The proposed video analysis solution shall meet all the requirements detailed in this A&E specification.

2 General Analytics Requirements

The requirements listed in this section apply to real-time detection, video search and business intelligence capabilities, unless stated otherwise.

Architecture

- 2.1 The contractor shall supply a server-client based solution that distributes the processing of the video image between firmware embedded in IP cameras and video encoders, and a server so that a server featuring a six-core processor shall be capable of performing analytics on at least 200 cameras simultaneously.
- 2.2 The system shall support processing video from specific Common Off the Shelf (COTS) IP cameras and video encoders.
- 2.3 Analysis of video shall be performed over a distributed architecture, separating processing of video from analysis of data between the edge device and a central server.
 - 2.3.1 Edge: Video shall be pre-processed at the edge by embedding a video feature extractor within COTS IP cameras or encoders. Low-bandwidth feature data shall then be sent to the central server for analysis.
 - 2.3.2 Server: Feature data received from the edge device shall be received and analyzed based on the rules configured by the user for real-time detection, or by settings automatically configured by the solution for video search & analysis.
- 2.4 In addition to video analysis distribution between the edge and a server, the solution shall provide an option to support IP cameras and encoders for which an embedded feature extractor is not available. This architecture option shall utilize a proxy mechanism that pulls the video stream from a 3rd party Video Management System (VMS) and performs the feature extraction on the server side.
- 2.5 The solution shall be easily scalable: the customer shall be able to add servers to the network to enable analytics on an unlimited number of additional cameras (without downtime).
- 2.6 The solution shall support full server redundancy, i.e., automatic switchover to backup components if the primary components fail. The capability is available in deployments of both the embedded feature extractor and the proxy feature extractor.
- 2.7 The solution shall support customized assignment between cameras and analytics servers, according to the customer's needs (e.g. geographic restrictions, etc.)

Bandwidth Consumption

- 2.8 The solution shall transmit extracted feature data with an average of 150 Kbps between the camera and the server.
- 2.9 The solution shall not send feature data when the analytics is not activated.

Hardware & Software

- 2.10 The solution shall run on computer networks using industry-standard equipment.
- 2.11 The analytics software shall be compatible with COTS equipment and common operating systems, in particular, Windows Server 2008 R2 SP1 (64-bit), Windows Server 2012 and 2012 R2 (64-bit), Windows Server 2016, Windows 7 SP1 (64-bit), Windows 8.1 (64-bit) and Windows 10 (64-bit).
- 2.12 The system shall have the ability to traverse both LAN and WAN network topologies.
- 2.13 The solution shall use an industry standard database for indexing alerts and storing configuration data. Supported databases include MS SQL Server Express Edition (2014, bundled with savVi), also 2012, 2016, MS SQL Server 2008 R2, 2012, 2014, 2016 (Standard and Enterprise Editions).
- 2.14 The solution shall support "Merge" replication feature offered by MS SQL Servers.

Performance

- 2.15 The solution shall be capable of delivering analytics to large-scale deployments comprising thousands of video cameras.
- 2.16 The solution shall be capable of detecting objects whose height is at least 5% of the Field of View (FOV).
- 2.17 The system shall function in diverse environments such as low light, rain, snow and clouds without loss of performance or significant increase in false real-time detection or false search results.
- 2.18 The system should automatically mask different types of repetitive movements that may otherwise cause false alerts.
- 2.19 The system should further allow the operator to specify mask areas within or outside the detection area in which any activity should be ignored, for reducing false alerts. Further, the operator should be able to define mask areas such that if movement of objects of certain sizes is detected, then other selected analytics rules configured on this camera would be deactivated to avoid false alerts.

Video Devices

- 2.20 The solution shall be capable of analyzing video streams originating from IP video surveillance cameras including: fixed color / B&W cameras; dome cameras; panoramic; thermal and infrared cameras.
- 2.21 The solution shall be capable of analyzing digital, compressed video originating from analog video surveillance cameras that are connected via video servers / encoders.
- 2.22 The solution shall enable video analytics on IP cameras and video encoders deploying an embedded feature extractor, from at least five different manufacturers.
- 2.23 For selected PTZ cameras that deploy an embedded feature extractor the solution shall enable real-time detection and alerts on PTZ presets as well as auto-tracking using the camera's PTZ capabilities.

Configuration and Management

- 2.24 The solution shall provide a single front-end application for all configuration operations.
- 2.25 The solution shall automatically detect all compatible IP cameras and video encoders (featuring an embedded analytics firmware module) present in the network:
 - a. Automatically detecting local sub-networks
 - b. Allowing the operator to specify any network subnet and IP address range
 - c. Detecting the type of the edge device
 - d. Automatically resolving IP addresses to the host name (of the detected IP cameras and video encoders)
 - e. Allowing the operator to select which of the discovered IP cameras and video encoders should be added to the analytics management system
- 2.26 The solution shall allow specifying one or more VMS server(s) to integrate with. For each of the servers, the solution shall retrieve its camera list that will be presented to the user using thumbnail images. The operator will be able to select VMS cameras that should be managed via the proxy mechanism.
- 2.27 The GUI shall enable the customer to configure frame rate usage in order to reduce network bandwidth consumption when viewing live video.
- 2.28 The solution shall be capable of automatically learning the camera scene, to enable optimal analytics performance, including:
 - The geometry of the field of view in terms of the pixel-to-meter measurement, in different areas
 - The camera orientation – angled or overhead
- 2.29 The solution shall allow configuring multiple sensors simultaneously
- 2.30 The solution shall display a reference image for each camera, to facilitate camera identification if there is no live video stream and to align the camera back to its original position if it is moved.
- 2.31 The solution shall provide an events history that includes the event image and the ability to view the recording playback around the event time.
- 2.32 The solution shall be capable of periodically purging accumulated data of various types based on age:

- Detection events
 - Statistics data (generated by business intelligence rules)
 - Analytics metadata
- 2.33** The solution shall include GUI to show current and past system notifications that represent the health of the solution's own software components
- 2.34** The solution shall generate system notifications for users' log-in and log-off times.
- 2.35** The solution shall forward the system notifications to the Windows Event Log, so they can be tracked and monitored by third party tools.
- 2.36** The solution shall allow 2 levels of user permissions. The lower level should be limited to viewing data and the upper level should allow all operations. The solution's user management shall allow specifying Microsoft domain users and groups.

Video Standards and Formats

- 2.37** The solution shall be capable of processing a variety of video resolutions, including: CIF, 4CIF, QVGA, VGA, 720P, 1080P, 3MP and 5MP
- 2.38** The solution shall be capable of processing a variety of compression standards, including: Motion JPEG, MPEG-4 and H.264.
- 2.39** The solution shall be capable of processing a variety of video aspect ratios, including 4:3 and 16:9.

Demo Capability

- 2.40** The solution shall feature the capability of importing video clips into the application for the purpose of testing, evaluating and demonstrating the quality of the analytics.

3 Rule-Based Detection & Analysis Capabilities

The requirements listed in this section apply to rule-based detection and analysis.

Configuration & Setup

- 3.1** The solution shall enable any combination of analytics rules to run on the same camera simultaneously, without limitations.
- 3.2** The solution shall enable the operator to define multiple detection regions per camera.
- 3.3** The solution shall provide the capability to activate, deactivate and apply a schedule on multiple analytics rules in bulk operation.
- 3.4** The solution shall enable the operator to define analytics rules that will be activated when other rules and/or scheduled times are activated. Chaining rules will be without limitation; it will be possible for each rule to activate and deactivate an unlimited number of rules on a single video camera and/or across multiple cameras. It shall be possible to activate all rule types simultaneously.
- 3.5** The solution shall enable the scheduling of analytics rules on a "weekly" recurring basis. The solution shall also allow scheduling for specific dates and times, via importing of an external calendar, such as the MS Outlook calendar.
- 3.6** The solution shall provide operators the ability to configure rule filters based on target size, target speed, aspect ratio or distance of movement.
- 3.7** The solution shall provide the capability to test the rule performance by leveraging historical metadata to which the rule conditions can be applied:
- 3.7.1** The user can specify the time period in the past to which the test should be applied
 - 3.7.2** It should be possible to run the test as soon as the analytics rule is defined
 - 3.7.3** Once running a test, the solution should display the recording snapshot at the event time and the detection overlays of the identified object
 - 3.7.4** The solution should allow the user to classify events as True or False
 - 3.7.5** Based on user classification, the solution should generate a score that provides a relative quality of the results
 - 3.7.6** The solution should allow saving past tests, showing the quality score for each test

- 3.7.7** The user should be able to review past test runs and apply the rule settings that correspond to one of the tests back to the rule definition

Analytics Rules for Behavior Detection

- 3.8** The solution shall offer a suite of analytics rules to provide automatic detection of a range of motion and non-motion behaviors of persons, objects and vehicles:
- 3.8.1** Person moving in area (alerts to movement of a person in a sterile zone)
 - 3.8.2** Person crossing a line (alerts to a person crossing a virtual line / wrong direction of movement)
 - 3.8.3** Crowding (alerts if the density (%) of people in a user-defined area reaches a user-defined threshold for a user-defined length of time)
 - 3.8.4** Person tailgating (alerts if a second person crosses a line within a user-defined time after the first person)
 - 3.8.5** Loitering (alerts to persons sojourning for a user -defined length of time)
 - 3.8.6** Occupancy (alerts if the number of people in a detection region exceeds a user-defined threshold)
 - 3.8.7** Suspicious object (alerts if an object is added to a scene, meets the operator-defined size, and stays for longer than the operator-defined time)
 - 3.8.8** Asset protection (alerts if a specific object is removed from an operator-defined region for longer than a defined time)
 - 3.8.9** Detect lighting (alerts if a light source, such as a traffic light, is turned on for longer than a predefined time)
 - 3.8.10** Vehicle moving in area (alerts to vehicle movement)
 - 3.8.11** Vehicle crossing a line (alerts to a vehicle crossing a virtual line / wrong direction of movement)
 - 3.8.12** Stopped vehicle (alerts to a vehicle that stops in a user-defined area for longer than a user-defined period of time)
 - 3.8.13** Tailgating vehicle (alerts if a second vehicle crosses a line after the vehicle that crossed before, within a user-defined time)
 - 3.8.14** Traffic congestion (alert if average vehicles speed is lower than a specified threshold for longer than predefined period)

PTZ Tracking

- 3.9** The solution shall enable multiple detection rule types on the presets defined in the virtual tour of PTZ cameras. In this operational mode, the solution shall track the target in the same way as is done on a fixed camera.
- 3.10** The solution shall enable motion detection and automatic tracking of a moving target on the presets defined in the virtual tour of PTZ cameras. When automatic tracking is initiated, the analytics solution shall control the camera's pan, tilt and zoom functions and maintain the tracked target centered with a minimal height of 20% of the FOV.

Tampering Detection

- 3.11** The solution shall be capable of detecting tampering and video quality in cases of video loss, camera obscuring, camera moving, light saturation, low light and TCP/IP communication problems.

Event Generation

- 3.12** The solution shall provide real-time generation of events to alert operators to irregularities.
- 3.13** The solution shall support simultaneous tracking of an unlimited number of targets within the detection regions and/or the cross lines.
- 3.14** The solution shall enable event on non-detection, i.e., for an alarm to be generated when a rule does not perform detection within a predefined period of time.

Analytics Rules for Business Intelligence

- 3.15** The solution shall offer analytics rules to provide business intelligence capabilities for persons and vehicles including but not limited to:

- 3.15.1 Count the number of persons moving directionally, i.e., crossing a virtual line/s that is user-defined in the camera's field of view. The solution shall optimize precise counting of targets by distinguishing individual targets in a cluster. If a cluster of 4 people crosses a line (for example), a count of 4 will occur rather than 1.
- 3.15.2 Count the number of vehicles moving directionally, i.e., crossing a virtual line/s that is user-defined in the camera's field of view.
- 3.15.3 Calculate average person occupancy within an area.
- 3.15.4 Calculate average person density (crowding) within an area.
- 3.16 Calculate average speed of vehicles passing within an area.
- 3.17 The solution shall include built in statistics reporting capabilities as follows:
 - a. For counting people and vehicles, listing all counting events and the reported count at each time interval
 - b. For counting people and vehicles, a report that compares multiple counters during a period of time
 - c. For counting people and vehicles, a report that aggregates the results of multiple counters
 - d. Person occupancy, density (crowding) and vehicle speed - reports that present the average values per hour or per day
 - e. For counting people and vehicles, an extended Excel report can be generated that includes absolute and comparative views for each day, month and year
 - f. Extended Excel reports indicated in (e) shall be producible offline, on the basis of a schedule, without requiring constant operator involvement
 - g. For all event types, a report that contains the details of each event and a captured image of the event.

3rd Party VMSs and Video Alarm Management Software

- 3.18 The solution shall integrate with 3rd party VMSs through open-standards, bi-directional, XML-based API, enabling the VMSs to receive events as XML strings, to parse the events, and to extract information such as source camera, event type and event snapshot.

Event Dispatcher

- 3.19 The solution shall enable the sending of real-time events to external applications such as designated video alarm monitoring software, email (SMTP) and SMS. The event notification includes the camera ID, event time and snapshot.

4 Video Search & Analysis Capabilities

The requirements listed in this section apply to video search capabilities for recorded video of a surveillance system. The specifications below apply to a typical deployment of a surveillance system in which video is recorded by a Video Management System (VMS).

Configuration and Setup

- 4.1 The solution shall not require the operator to apply any rule or behavior configuration in advance.
- 4.2 The solution shall allow the operator to enable or disable generation of video indexing per sensor.
- 4.3 The solution shall allow the operator to specify the maximum duration (in days) to store the video index per sensor. When the specified time limit is reached, the solution shall purge the oldest index data from the database.
- 4.4 The solution shall allow the operator to delete all previously stored index data per sensor. For all the above three sensor operations, the solution shall provide the capability to configure multiple sensors via a single GUI operation.
- 4.5 The solution shall offer a suite of search options in the range of motion and non-motion behaviors of persons, objects and vehicles (search targets):
 - 4.5.1 Person moving for a specified time, in the entire FOV or in a specified AOI (area of interest)
 - 4.5.2 Person crossing a line
 - 4.5.3 People crowding for a specified time, in the entire FOV or in a specified AOI (based on a user-defined crowd size percentage threshold)
 - 4.5.4 Persons occupying for a specified time the entire FOV or a specified AOI (based on a user-defined occupancy threshold)
 - 4.5.5 Vehicles that moved for a specified time, in the entire FOV or in a specified AOI
 - 4.5.6 Vehicle crossing a line
 - 4.5.7 Vehicle that stopped for a specified time, in the entire FOV or in a specified AOI
 - 4.5.8 Object that was added for a specified time, in the entire FOV or in a specified AOI
- 4.6 The solution shall allow filtering based on target characteristics:
 - 4.6.1 Vehicle size. The solution shall provide predefined presets for Small, Medium, Large and Any vehicle
 - 4.6.2 Object size. The solution shall provide predefined presets for Small, Medium, Large and Any object
 - 4.6.3 Target color. The solution shall provide a predefined palette of colors to choose from. It shall be possible to specify up to two colors to be matched. The solution shall enable searching for targets that match the specified color(s) or targets that don't match the specified color(s).
- 4.7 The solution shall be capable of searching over various time range options:
 - 4.7.1 Over the past N minutes, hours or days (e.g., over the past 3 hours; past 7 days)
 - 4.7.2 From a start date and time to an end date and time
 - 4.7.3 Over a recurring time interval across a date interval (e.g., between 8-9 a.m., every day between Jan 1-10)
- 4.8 The solution shall enable adjusting the search parameters tolerance to yield fewer or more search results (while decreasing or increasing the probability for true and false matches)
- 4.9 The solution shall provide the capability to Search for Similar Targets. If a target is found, another search can be performed in the recorded video (generated from the same camera or any group of cameras) to find targets that are the same as or similar to the found target.

Viewing Search Results Capabilities

- 4.10 The solution shall provide a fundamental capability to display video playback for any search result around the time that the search target / behavior was found:
 - The solution shall continuously display a bounding box over the target (target tracking)
 - The solution shall display the video playback in an infinite loop

- The solution shall present a progress bar, including a graphic indication showing the time at which the search criteria were met
- The solution shall enable the user to Pause and Re-Play the video playback
- The solution shall enable the user to use the progress bar to navigate to any time position along the playback segment
- The solution shall be capable of zooming into the original video source so that users shall be able to optimally view tracked targets in video playback
- The solution shall feature playback windows of at least two possible sizes and with an aspect ratio that correlates to the original video recording, such as 4:3 or 16:9
- The solution shall feature video playback extracted from either the integrated VMS or from the video clip, depending on the deployment

The playback capability should be further incorporated with several viewing options as described below.

4.11 The solution shall provide multiple options for viewing search results:

- 4.11.1** Event Thumbnails: After searching cameras, the solution shall be capable of displaying thumbnail results, each of which shows a found person, vehicle or object behavior. It shall be possible to play back the video of each thumbnail. The solution shall be capable of zooming into the original video source so that users shall be able to optimally view tracked targets within the displayed thumbnail. The thumbnail will be extracted from either the integrated VMS or from the video clip, depending on the deployment.
- 4.11.2** Statistics Report: The solution shall enable counting the search results and presenting the information as:
 - Graphic statistics report by time intervals
 - Graphic statistics report by sensor (allowing comparison of search results across cameras)
 - Graphic statistics report exported to PDF file
 - Raw counts exported to Microsoft Excel file
- 4.11.3** Target Path / Location: After searching, the solution shall be capable of displaying all motion paths in a scene over the field of view reference image. For non-motion behaviors (such as suspicious object and stopped vehicle), the solution shall present the bounding rectangle in the location that the target was found. It shall be possible to immediately play back the video of each target path or target location.
- 4.11.4** Heat Map: After searching, the solution shall be capable of displaying results in a view that uses color coding to represent relative activity in different areas of the field of view, highlighting areas in which targets sojourned longest.
- 4.11.5** Video Summary: After searching, the solution shall be capable of displaying multiple search results in a single condensed, segmented clip. It shall be possible to easily navigate from one video segment to another as well as to directly navigate to any position in the condensed clip.
- 4.11.6** Site Map: The solution shall enable viewing search results on a graphic image representing a site map:
 - a. The solution shall enable viewing Heat Map and Target Path on the site map
 - b. The solution shall be capable of presenting the results of searches on multiple cameras, on a single site map
 - c. The solution shall allow navigating to the video playback directly from the site map for a given cell (in Heat Map) or a given Path
 - d. The solution shall enable viewing a maximal size of the site map image showing the search results
 - e. The solution shall allow defining multiple site maps and associating them with a subset of cameras
 - f. Image files shall support the following formats: *bmp, jpg, jpeg, gif* and *png*

- g. The solution shall provide a simple method to correlate between the camera coverage area and the site map graphic image.

Process and Investigation Capabilities

- 4.12 The solution shall provide the following process and investigation capabilities:
 - 4.12.1 Save Search Query: Users shall be able to save a search query with a given name for later reuse.
 - 4.12.2 Save Search Results: Users shall be able to save search results with snapshots of the detections and the results' identifying information (camera ID, time). Multiple results from a single search or from multiple searches can be saved under a single or multiple names (as required by the user) and can be retrieved as a reference later.
 - 4.12.3 Export Clip: The solution shall enable users to export a search result to an .avi file, for a single result as well as for a complete video summary. The exported clip will include the target tracking display.

Performance

- 4.13 The solution shall be capable of a query time average of 10-15 seconds per camera per 24 hours of recorded metadata, depending on how busy the scene has been during the search time interval and on the hardware configuration of the server.
- 4.14 The solution shall require an average video index storage of 50 MB per camera per day

3rd Party VMSs

- 4.15 The solution shall integrate with 3rd party VMSs through a VMS provided API that the solution shall use to retrieve images and video playback for the search results.

Client Access

- 4.16 The solution shall be capable of handling concurrent GUI clients that access the solution and perform video search & analysis.