AGENT VI

Comprehensive Video Analytics Solutions

2016

White Paper

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1 What is Video Analytics?

Video Analytics, also referred to as Video Content Analysis (VCA), is a generic term used to describe computerized processing and analysis of video streams. This paper will use the term "Video Analytics" with regards to the analysis of video streams captured by surveillance systems. Video Analytics applications can perform a variety of tasks ranging from real-time analysis of video for immediate detection of events of interest, to analysis of pre-recorded video for the purpose of extracting events and data from the recorded video.

Relying on Video Analytics to automatically monitor cameras and alert for events of interest is in many cases much more effective than reliance on a human operator, which is a costly resource with limited alertness and attention. Various research studies and real-life incidents indicate that an average human operator of a surveillance system, tasked with observing video screens, cannot remain alert and attentive for more than 20 minutes. Moreover, the operator's ability to monitor the video and effectively respond to events is significantly compromised as time goes by.

Furthermore, there is often a need to go through recorded video and extract specific video segments containing an event of interest. This need is growing as the use of video surveillance becomes more widespread and the quantity of recorded video increases. In some cases, time is of the essence, and such review must be undertaken in an efficient and rapid manner.

Surveillance system users are also looking for additional ways to leverage their recorded video, including by extracting statistical data for business intelligence purposes. Analyzing recorded video is a need that can rarely be answered effectively by human operators, due to the lengthy process of manually going through and observing the recorded video and the associated manpower cost for this task.

While the necessity for, and benefits of, surveillance systems are undisputed, and the accompanying financial investment in deploying such surveillance system is significant, the actual benefit derived from a surveillance system is limited when relying on human operators alone. In contrast, the benefit accrued from a surveillance system can be significantly increased when deploying Video Analytics.

Video Analytics is an ideal solution that meets the needs of surveillance system operators, security officers, and corporate managers, as they seek to make practical and effective use of their surveillance systems.

2 What is Video Analytics Used For?

Video surveillance systems are typically installed to record video footage of areas of interest within a facility, around its perimeter or in outdoor areas which require observation, with a view to "catching" (allowing the user to be able to observe) and recording events related to security, safety, loss prevention, operational efficiency and even business intelligence.

Video Analytics enhances video surveillance systems by performing the tasks of real-time event detection, post-event analysis and extraction of statistical data while saving manpower costs and increasing the effectiveness of the surveillance system operation.

2.1 Video Analytics for Real-Time Detections & Alerts

Through the implementation of various image processing algorithms, Video Analytics can detect a variety of events, in real-time, such as:

- Penetration of unauthorized people / vehicles into restricted areas
- Tailgating of people / vehicles through secure checkpoints
- Traffic obstacles
- Unattended objects
- Vehicles stopped in no-parking zones, highways or roads
- Removal of assets
- Crowding or grouping
- Loitering

And more.

By defining the set of events that the surveillance system operator wants to be alerted to, the Video Analytics software continuously analyzes the video in real-time and provides an immediate alert upon detection of a relevant event.

2.2 Video Analytics for Investigation (Video Search)

Video Analytics algorithms may be implemented to analyze recorded video, a task that is challenging and time consuming for a human operator, especially in cases whereby a large amount of video must be reviewed. Through rapid analysis of recorded video, Video Analytics can pinpoint an event in recorded video, and retrieve the relevant video segments from the stored video.

Through the use of search queries, the surveillance system operator defines the event desired in a specific segment of recorded video. The Video Analytics system analyzes the video and provides the search results through an automated search, without requiring any additional intervention from the operator.

2.3 Video Analytics for Business Intelligence

Video Analytics algorithms can also analyze recorded video to extract statistical and operational data. Rather than having an operator manually review the video and tally all the people or cars moving in a certain area, or checking which traffic routes are most commonly taken, Video Analytics can perform these tasks automatically.

The surveillance system operator defines the data required as well as the time period to be analyzed, and the Video Analytics system provides results following an automatic review of the recorded video. No manual review is required by the operator.

3 Video Analytics Architectures

Video surveillance systems typically include the following main components:

- Video cameras
- Network infrastructure
- Security management solutions (Video Management Systems, Command & Control Systems etc.)
- Storage
- Video Analytics

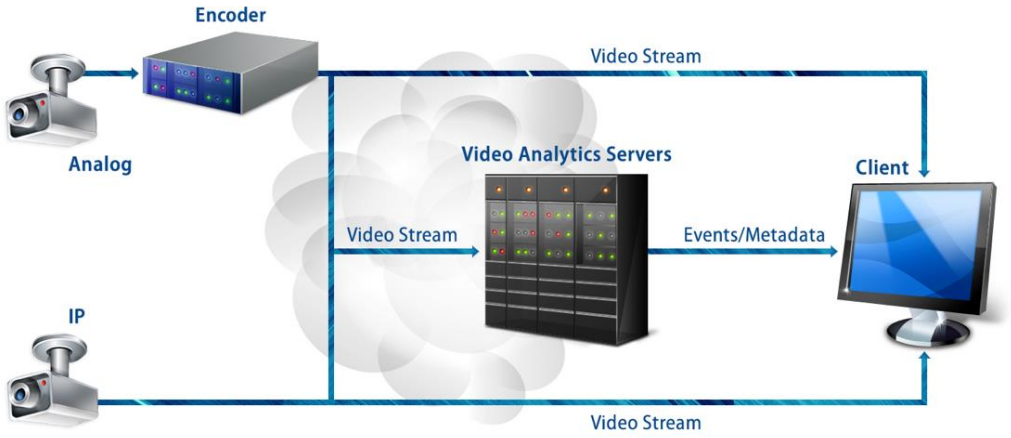
Video Analytics can be implemented in three different configurations, which correlate to the evolution of the Video Analytics and surveillance technologies:

3.1 Server-Based Implementation

In this approach, the Video Analytics is implemented through a dedicated server that pulls the video from the camera, analyzes it, and issues the alerts or analysis results. This approach is independent of the video cameras, and therefore, is applicable to most types of surveillance systems. The main disadvantages to this approach are:

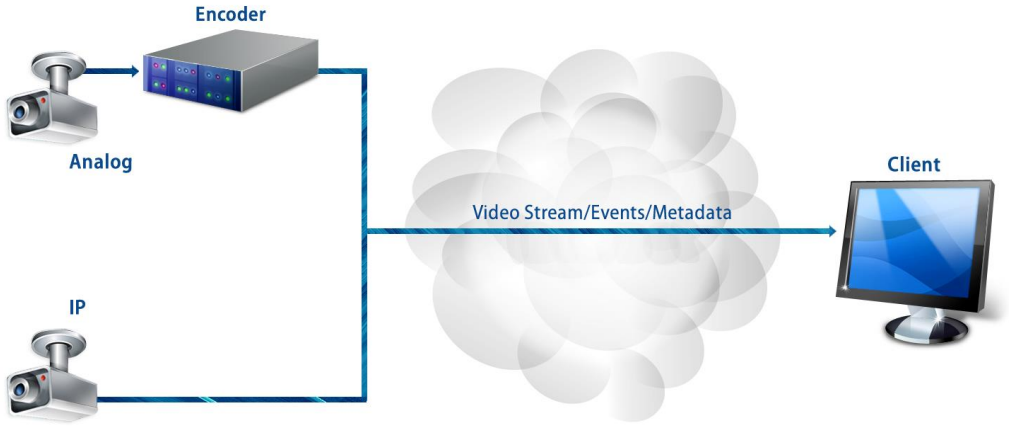
- The Video Analytics server requires the video to be transmitted to such server, and therefore causes an increase in network traffic load;
- The video quality being analyzed by the Video Analytics server is usually degraded due to compression and transmission effects, and therefore, the Video Analytics performance may be compromised;

- The Video Analytics server is limited by its processing power, which makes it unattractive to large scale surveillance installations which deploy hundreds (and increasingly thousands) of cameras requiring a variety of Video Analytics functionalities.



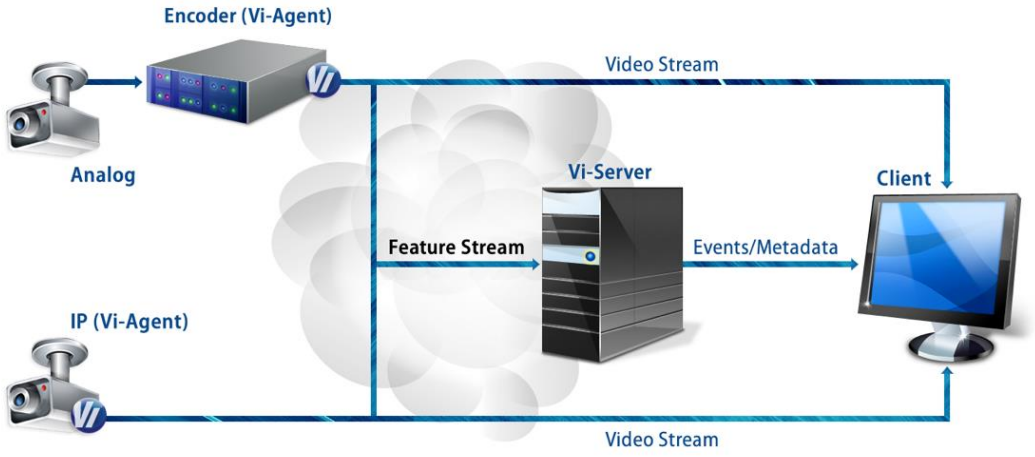
3.2 Edge-Based Implementation

In this approach, the Video Analytics is implemented through an IP video camera or video encoder, which must have sufficient processing power to run the Video Analytics functionality. On the surface, this approach seems ideal, however it does not perform satisfactorily in many cases as it imposes limitations on the overall surveillance system design and performance. Most edge devices still lack sufficient processing power for high-end Video Analytics requirements, and therefore such implementation compromises on either the range of functions or performance quality of the Video Analytics, or both.



3.3 Agent Vi's Distributed Implementation

Agent Vi has a unique and patented architectural approach to Video Analytics, called "Image Processing over IP networks" (IPoIP™). With Agent Vi's architecture, the Video Analytics task is distributed between the edge device (which may be an IP camera or encoder) and a server. This approach optimizes the workload on the edge device and server and yields high quality analytics performance. A key benefit to Agent Vi's distributed architecture is that a single server can run comprehensive Video Analytics functions on hundreds of cameras simultaneously. This hardware efficient camera-to-server ratio is achieved without compromising on the range and performance of the analytics functionality, which makes it especially beneficial for large scale surveillance installations.



4 Video Analytics as a Service

The past few years have seen a major shift in software product delivery from on-premise installation to cloud-based services. This shift is bringing multiple benefits to customers including:

- Lower total cost of ownership (TCO)
- Minimal upfront fees
- Faster product and feature updates
- Improved support

While these same benefits can be enjoyed by users of video analytics, it is not as straightforward as with other types of software. One of the barriers in using cloud-based services is bandwidth consumption. In order for server-based video analytics to work in the cloud, it would require high quality video to be continuously uploaded from the user's sites to the cloud. This is not a practical approach for most users as the bandwidth requirement per camera will typically be more than 1Mbit per second which would severely limit the number of cameras that can be processed.

Agent Vi's IPoIP architecture is ideal for enabling a cloud-based approach. Since the server in the cloud does not need access to the full video stream, it can provide a more than x20 increase in the number of cameras that can be handled on existing bandwidth vs. a classical server-based approach.

5 Machine Learning in Video Analytics

Deep learning is a relatively new technique in machine learning which enables (among other applications) very accurate classification of images. Correct application of this technology within video analytics can provide a dramatic increase in accuracy alongside a dramatic decrease in false alarms which have long been the Achilles' heel of video analytics applications in surveillance. Deep learning can also bring about new types of applications that allow more accurate classification between different types of objects. For example, video analytics can be used for detecting bicycles vs. motorcycles in an urban environment, and as a result, an alert can be generated when a motorcycle is detected on a bicycle path.

The downside of deep learning is the required computational resources. Deep learning demands high CPU requirements, and accordingly, most practical implementations of deep learning algorithms rely on the use of GPUs (Graphical Processing Units) for achieving good price performance ratio. Currently GPUs are only available in a server environment which means that any video analytics application that seeks to apply deep learning has to have a server component.

Agent Vi's IPoIP architecture provides a tremendous advantage by allowing the GPUs to reside in the server while still maintaining all the benefits of the distributed architecture.

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