Whitepaper



AVIGILON™

Audio Analytics

with Avigilon Alta Aware

MOTOROLA SOLUTIONS

Audio analytics

Summary

Most physical security systems rely only on vision to detect or record events of interest. Avigilon Alta Aware includes audio detection in the vicinity of any Avigilon Ava camera or Avigilon Alta cloud-native camera equipped with a suitable microphone. Using both sound and vision helps identify when events of interest occur inside or close to your buildings.

The Avigilon Alta cloud video security difference

Until recently, to create a system that combines both audio and video analytics in a single physical security solution required equipment from different hardware and software vendors.

This was expensive, and often difficult to integrate and maintain the components needed to include audio and video detections in the video management system. By using a multi-vendor model, the potential security and privacy risks included in the combined system also increased.

All Avigilon Ava cameras, and Avigilon Alta cloud-native cameras with suitable audio components, can identify unusual sound events; for example, breaking glass, loud noises, a gunshot, somebody screaming, fire, smoke, or car alarms, dogs barking, tire screeching or other anomalous sounds. Avigilon Ava cameras also detect ultrasonic frequencies, enabling them to be used to detect the location of a panic alarm.

With audio analytics on-board each Avigilon Ava camera and Avigilon Alta cameras with a microphone, operators gain a better understanding of the environments they are monitoring.

By using both video and audio analytics together, you have better coverage of the areas you need to monitor, as the sounds do not necessarily need to originate from within the fields of view of your cameras, and are still detectable even when they come from behind pillars or other objects.

With the Avigilon Ava 360 and Avigilon Ava Dome cameras, you have directional audio analytics highly integrated into your Alta Aware video management systems.



With the Avigilon Ava Compact Dome, Avigilon Ava Flex and the Avigilon Alta cloud-native cameras, you have the same audio analytics, but without the ability to determine direction. You do not need to buy additional equipment or use software plug-ins to enable the audio analytics for the Avigilon Ava cameras. For compatible Avigilon Alta cameras, you can connect either an internal (for indoor Dome models) or external microphone to enable the audio analytics. The Alta Aware video security solution is an end-to-end system, created by a team of engineers with 20+ years of experience in advanced high-end audio and video system design and engineering:

→ Hardware

For Avigilon Ava cameras, we designed the audio system specifically to meet physical security requirements, taking it all the way from concept to mass production. By using best-in class digital Micro Electro-Mechanical System (MEMS) microphones, and a new and robust acoustic design with a compact form factor that protects the microphones from dust and liquid while maintaining excellent pickup sensitivity and consistency, we created devices suitable for all environmental needs. By incorporating microphones into each Avigilon Ava camera, you save on the expense of having to purchase, install and maintain separate microphone and video detection systems, without needing to configure the communications between disparate audio and video solutions. Each camera is tested on a state-of-the-art audio production test system at the production line to validate and assure performance and resilience.

→ Software

Using a highly-optimized deep neural network and the power of modern data science and classical array processing technologies, the audio pre-processing module suppresses ambient noise, enhances the interesting signals and extracts the best features for audio event classification. These output results are used to raise alerts if unusual sounds are detected. For multi-microphone arrays, the processing module estimates the time difference of the arrival of the sound source at each microphone, and calculates the directions-of-arrival in azimuth and elevation angles. The classification, and where available, the direction information is passed securely from the camera to the Alta Aware deployment, where alarms are raised to notify the operator. The Alta Aware user interface shows these alarms as alerts in the Alarms tool, and also on the Video view and Map view tools, enabling your operators to watch the relevant video recordings, isolate the cause and take actions based on the information provided by both the directional audio and the video analytics.

→ Data collection, labeling and deep learning

To create the class-leading audio classifications, while minimizing false positives, Avigilon Alta video engineering have recorded thousands of hours of sound in real world installation scenarios and in relevant environments. This data is accurately labeled and structured by our audio experts to create our highly-optimized, accurate and flexible neural networks for audio analytics. These neural networks, running inside each Avigilon Ava and Avigilon Alta (with microphones fitted) camera, then detect unusual or loud sounds, classifying them into relevant categories to allow the Alta Aware video security solution to raise events, or for you to create suitable rules that trigger on certain sound types.

→ Privacy

To protect the privacy of people located near to your compatible cameras, you have control over how sounds are processed and analyzed inside each camera. You can configure each camera so that only the metadata about each detection is sent to your Alta Aware deployment, or can send short sound clips and the metadata about each detection. For situations where it is necessary to record audio, you can configure each compatible camera to store the audio that corresponds to each alert.

→ Integration with Alta Aware

The audio analytics from each Avigilon Ava camera are seamlessly integrated into the user interface of Alta Aware. Where appropriate, you can configure the microphone array orientation, and select sound profiles for every Avigilon Ava camera in only a few mouse clicks. You can also create audio alarm rules, so that, when an audio event occurs, Alta Aware highlights the event in the user interface, and can send email or other communications platform notifications to enable you to instantly react to the situation, rather than having to wait for a witness call. Using Map view, your operators are also shown the location of the camera that detected the audio event.

About directional audio analytics

For Avigilon Ava cameras with built-in 4-microphone arrays, the camera can capture directional information from the sound field. So, not only can your Avigilon Ava cameras detect and identify unusual sound events but, depending on the camera model, they also alert your operators to the location from which the sound originated, in near real time.

Ultrasonic detection

As well as being able to detect noises in the audible spectrum, Avigilon Ava and compatible Avigilon Alta cameras are also designed to detect ultrasonic frequencies. Ultrasound can be used to accurately pinpoint the location of a device that emits suitable sound frequencies, and has several advantages over other technologies that can be used to pinpoint a device, for example GPS, Wi-Fi, bluetooth, and RF systems. These advantages include:

- Ultrasound can be used indoors.
- Ultrasonic waves do not pass through walls or ceilings, so your detections are confined to the areas in which the device is located, preventing Avigilon Ava cameras in other rooms or floors from erroneously alerting on the alarm.
- You do not need additional equipment to implement a system to detect ultrasound signals.

This feature can be used, for example, to create a panic alarm that plays ultrasonic frequencies between 18 - 20 kHz, that when triggered in the vicinity of Avigilon Ava cameras, can be used to "silently" alert your security staff to a situation on your premises, and be used to pinpoint the location of the alarm being triggered.

Expected performance

The accuracy and performance of the audio analytics from all cameras very much depends on the environment in which the cameras are installed.

By either wall or ceiling mounting your compatible cameras, and ensuring the installation locations are at least one meter away from noise sources such as air-conditioning units, ventilation ducts and fans, the following ranges for different audio detections are possible:

Table 1 - Audio detection range

DETECTION	RANGE (IDEAL)	RANGE (NOISY)
Glass Break	Up to 15 meters	Up to 8 meters
Gun shot	Up to 100 meters	Up to 50 meters
Screaming	Up to 15 meters	Up to 8 meters
Smoke alarm	Up to 15 meters	Up to 8 meters
Car alarm	Up to 30 meters	Up to 20 meters
Ultrasonic panic alarm	*Up to 40 meters	*Up to 20 meters

*For Ultrasonic panic alarms, the detection range is influenced by the quality and power of the device used to create the panic alarm. In testing, panic alarms created using mobile telephones can usually be detected when within 15 meters of an Avigilon Ava camera.

For loud noise detections, the audio detection range is dependent on the type and source of the noise. For example, a gunshot is detected at much greater range than a hand clap or slamming door. This makes it difficult to predict the detection range without knowing the type and source of the noise.

In some conditions (loud background noise, strong room reverberation, etc.), the detection performance and working range degrades.



Use cases

Being able to detect audio events, and, depending on the model of camera, to be able to triangulate the source of that noise, has many applications in different sectors. Here are some relevant examples:

Retail sector

Statistics show that retailers are concerned about violence and verbal abuse against staff – with 48% having experienced it – loss prevention, and antisocial behavior. The audio analytics from Avigilon Ava and Avigilon Alta cloud-native cameras identify sounds and offer situational awareness of store premises. Adding directional information from the relevant Avigilon Ava cameras further enhances this situational awareness.

Retailers can detect and act on aggressive behavior, vandalism and robberies to safeguard customers and staff, and to reduce shrinkage. Issuing employees with suitable ultrasonic panic alarms provides an additional level of protection.

Education sector

To monitor schools and campuses, operators have to balance proactive measures with effective incident response. Conventional security solutions lack insights to make operators truly efficient. The Avigilon Alta integrated audio analytics capability is a valuable asset in several cases.

Reports show that 19% of students in grades 9–12 have been bullied on school property. Globally, about 150 million students aged 13-15 report facing peer violence at their schools. Acts of verbal aggression and fighting can occur anywhere on campus: classrooms, hallways, gyms, cafeterias, bathrooms or playgrounds. Our cameras' microphones can identify screaming and loud noises, as well as the direction of the commotion even when the camera is pointing in a different location. By providing your staff with ultrasonic panic alarms, they can also quickly call assistance in situations when backup is required.

Gun violence is an unfortunate reality many schools face. By installing cameras with embedded directional audio analytics, campus administrators are better equipped to identify and assess attackers and their location before they endanger more lives.

Commercial real estate and offices

Securing commercial buildings goes beyond safeguarding people and property. Today's security professionals respond to the needs of the business, staff, contractors and visitors and deal with the realities of property damage, theft and disgruntled employees.

Avigilon Alta integrated audio analytics helps security staff react to breaking glass, loud noises, screaming, gunshots, smoke alarms or panic alarms. Going to the source of the disturbance as fast as possible can make the difference before threats escalate.

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Healthcare sector

Administrators of healthcare facilities are constantly challenged to keep patients, staff, visitors and property protected. With Avigion Ava and compatible Avigilon Alta cameras, security operators can detect and contain verbal aggression incidents against staff or patients before they escalate.

It is also easier for staff to monitor high-risk patients, as well as identify and assist patients who slip and fall. The cameras' microphones pick up loud noises, screaming and glass breaking, and send alerts in real-time. Providing your staff with ultrasonic alarms means that they can quickly call assistance when needed.

Conclusion

By integrating microphones in Avigilon Ava and compatible Avigilon Alta cameras, and developing and training the audio analytics, the Avigilon Alta video security solution adds features that provide real value to your organization.

By being able to pinpoint the location of loud noises and other audible and inaudible sounds and overlaying this information onto the Alta Aware user interface, your operators gain more awareness of their environment than they would get from a traditional video-only system.

With Alta Aware able to issue suitable alerts and events to your operators even when they are away from the monitoring stations, Avigilon Alta's audio and video analytics provide enhanced oversight of your protected areas.



To learn more, visit: www.avigilon.com

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