

Tuning VCA for Real Life

Many factors contribute to a reliable intelligent video implementation, and the algorithm is but one of them. On-site calibrations and camera considerations are also critical for video analytics to function properly.

BY GARY TANG

For an algorithm to make sense of a scene, it must identify the objects it sees. It looks for movements in the picture through changes in pixels, finds out if a group of moving pixels constitute a coherent object and checks if the object matches a certain criterion to estimate what the object is, said Katharina Geutebrück, MD at Geutebrück. “A very simple example is if the object is taller than its width, has a face and is approximately the size of a person, then the algorithm decides it is quite possibly a person and responds accordingly.”

To make this logical deduction, the algorithm must be told how big a person would be in the image when he is in the foreground, and how big he would be when he is in the background, Geutebrück continued. “This is done during the setup when the service engineer ‘measures’ the scene to determine how wide the foreground and background are.”

Calibration is an integral part of any video analytics installation, said Mahesh Saptharishi, Chief Scientist at VideoIQ, in a prepared statement. “The generally accepted meaning of calibration in video analytics focuses on defining the height and size of a human in the specific field of view of an individual camera through a manual process. Vehicle detection, be it cars, boats or bikes, is calibrated in a similar manner.”

CALIBRATION

Calibration is typically performed after the corresponding camera is mounted and multiple points in a scene are mapped out and recorded with a consistent object, such as a pole, Saptharishi said. “The pole helps the camera determine the height of an average human being and trains it to trigger an alarm when something at that height enters a field of view.”

The expectation is that the field of view is not going to change dramatically, including landscape, trees and other objects, and the camera will never be repositioned or knocked during routine maintenance, Saptharishi continued. “The process is laborious and time-intensive;

because it largely relies on a single characteristic, such as object height, manual calibration does not always provide the most optimal threat detection.”

One constraint has been the complexity of installing such a system in the field and obtaining optimal results, said Zvika Ashani, CTO of Agent Video Intelligence. “Reducing setup complexity will contribute to greater market penetration of video content analysis (VCA).”

As companies look more and more to active surveillance systems with analytics, ease of installation and maintenance become increasingly important, Saptharishi added.

With metadata and forensic searches, the user can install the camera and leave it running for a certain amount of time — maybe a couple of weeks or a month or two. “Now, you have all the environmental dependencies and variables, such as sunrise, sunset, rain, maybe even snow,” said Gerard Otterspeer, CCTV Product Marketing Manager, Bosch Security Systems. “The engineer then tweaks the system to a level where the customer can accept the rate of false negatives and positives. Copy that into live-alarm settings, and the system is good to go.”

Self-learning algorithms are now available with some solutions. Some software can analyze targets in the field



▲ VCA must be tuned to know which elements in the scene are or are not relevant information to the human operator.

of view and automatically determine the camera angle, environment (indoor or outdoor) and pixel-to-meter ratio at various distances, Ashani said. "This feature removes some of the manual configuration that was previously required."

However, while auto-configuration is now available for those who have very simple requirements, those who have complex needs should have a trained engineer implement the system, warned Ivy Li, cofounder and MD of iOmniscient. "This is not unreasonable. When you want to install a tap, you normally hire a trained plumber to put it in; and this is a basic technology that has been around for more than 1,000 years."

BRINGING IN THE EXPERTS

"VCA is very sophisticated. Just as one would be reluctant to board an airplane piloted by an untrained person, one should not expect an untrained person to implement VCA," Li said.

Trained and experienced integrators should explain to customers that a VCA system might take two to three

weeks to "settle in," said Patrick Lim, Director of Sales and Marketing for Ademco Far East. "During this time, we hope to encounter as many situations as possible. Sometimes, we will create possible scenarios, such as 'attempted intrusion during a rainy night.' Our engineers will try to fine-tune the system until it can deal with all the expected scenarios."

For example, if a person is obscured by objects within a room, walking behind a parked vehicle, or partially hidden by shrubs, then only a fraction of an individual's head and torso can be visible to the camera, resulting in a missed detection, Saptharishi said. "To prevent this, analytics that require manual calibrations often have to simulate all possible scenarios during the installation process, including having individuals walk within an area with and without cars in order to properly detect partial objects. Moreover, as foliage changes and new objects are included in a field of view (such as dumpsters), cameras need to be recalibrated to detect properly in the new scene."

The ability to "back-process" information against a

video archive also comes in handy. During the tuning and training of a system, variables and parameters within the asset management system can be changed, and data reprocessed for comparison purposes, said Tim Chandler, President of CoastalCOMS, Coastalwatch. "This allows for modeling of various outcomes until a set of parameters matches the desired level of accuracy. Confidence level reports then indicate how closely outputs match the desired level of accuracy."

CRYING WOLF

False alarms arise for a number of reasons. For example, typical sources of false positives for people counting are shadows from people walking outside the field of view of the camera, and these can be minimized by proper positioning of lighting, Ashani said. "False negatives might occur when an adult and child are passing through and walking very close together. The software may mistake them as one person. There is no effective way to get around this, but statistically speaking, this situation is rare enough."

Usually, high false alarms can stem from wrong applications of the technology, poor products, bad installations and poor understanding, Lim said. "No verticals should ever accept frequent false alarms; thus, the first three factors must be thoroughly tested in proof of concepts or pilot projects."

Proper definition of false alarms is also a significant challenge, Lim continued. "It is normal that environmental factors such as trees and weather can cause some false alarms, but these should have minimal effects for a properly calibrated system. However, if a suspect's action is detected as a potential intrusion, though it did not happen, it should not be determined as a false alarm."

When a system constantly generates alarms when there is no good reason to do so, "operators cease to treat them as critical situations; they begin to dismiss or ignore alarms without proper verification," Geutebrück said. "Then, the human operator is back to square one. The system ends up providing nothing but a false sense of security."

THE EYES

While the analytics are the brains, the cameras are the eyes. As with human vision, the healthier the eyes, the better the vision; the advent of HD and megapixel cameras greatly increases the practicality of VCA.

"We are always delighted when our customers choose manufacturers whose products provide consistently

good images required for video analytics," Li said. "We sometimes cringe when the customer insists on using certain brands which we know will cause problems because they were not designed with VCA in mind."

When customers insist on using older analog cameras, integrators and installers face difficulties in achieving the full suite of VCA features, Lim agreed. "Megapixel cameras definitely provide more possibilities to apply the VCA features."

CAMERA PLACEMENT

Appropriate camera placement is also important. For example, people counting is impractical when the camera is not mounted correctly, Ashani said. "A low hanging camera mounted at an angle will make the count very inaccurate as people passing through the field of view will be blocking each other."

A top-down view at the right height can provide maximum accuracy for people counting, Li added.

Another example could be to detect a person moving toward the camera, Ashani said. "A camera that is almost parallel to the ground will detect little directional movement."

STAYING IN THE LOOP

An often ignored element is the work flow. Even if VCA were 100-percent accurate — which is currently impossible — work flows must also be in place to support an alarm, Chandler said.

"For instance, we have the ability to use thermal cameras to detect someone fishing or poaching on a reef in the middle of the night, and our VMS can notify customers via alarm," Chandler continued. "But who verifies the alarm? Who is dispatched? Often times, there are no blueprints for how to deal with the ever-growing amount of information VCA can provide, so we help policy makers understand options and change frameworks to support these new types of metrics and alarms. We feel the landscape is changing, and that VCA adoption will continue to grow as customer response frameworks better support what VCA can provide."

An alarm may be a digital signal, but the coordinated response should not be based on the simple yes/no/true/false questions that VCA answers, Chandler added. "The goal is to put supporting information back into the hands of decision support managers who must ultimately make the call." VCA cannot save lives in our world — humans do!

