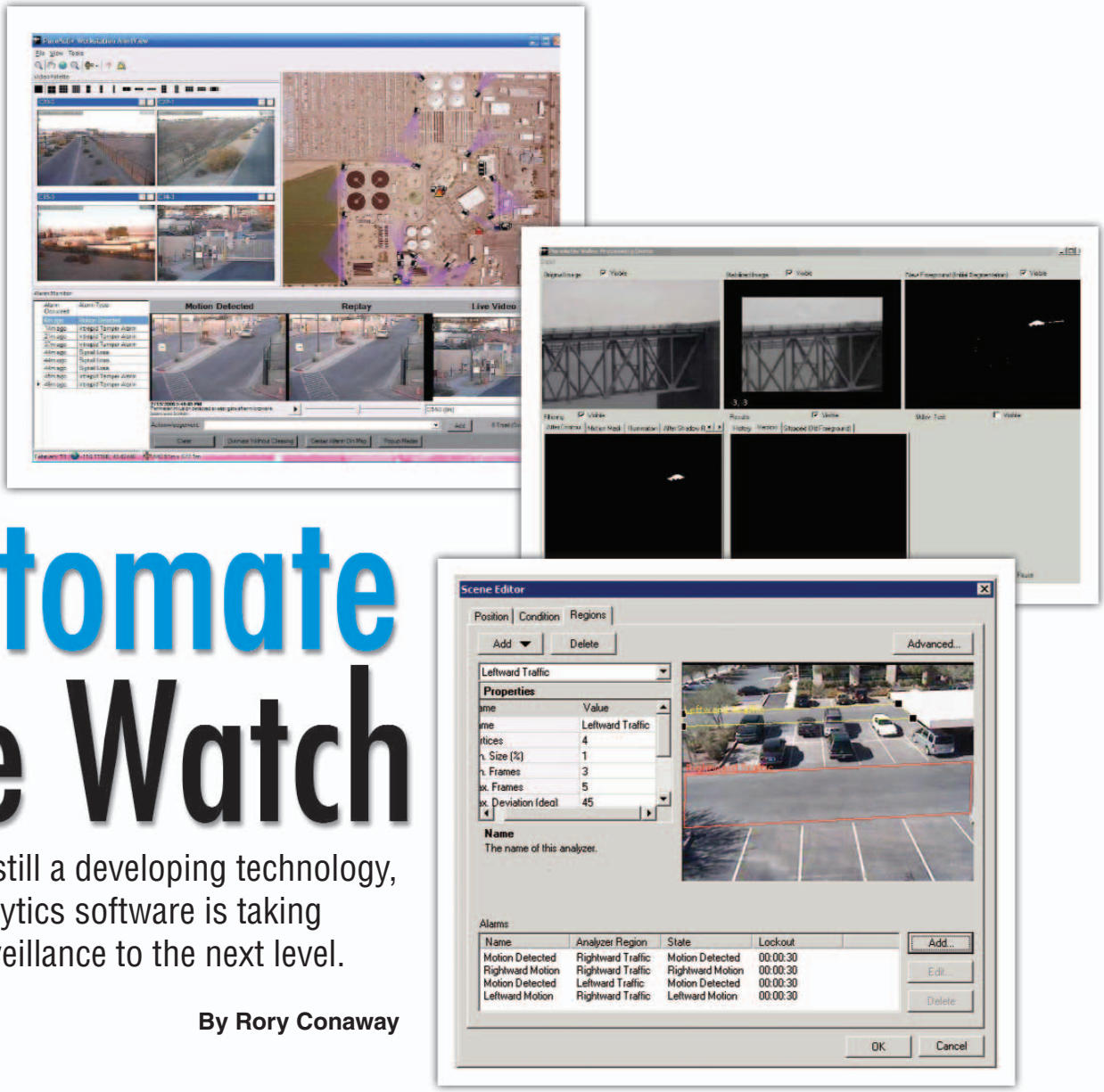

Automate the Watch

Although still a developing technology, video-analytics software is taking video surveillance to the next level.

By Rory Conaway

Staring at tens or hundreds of monitors for hours daily would quickly bore most people. Those that wouldn't get bored could inevitably miss key events. It's almost impossible for a person to watch more than a few monitors with a great deal of precision. In many cases, monitors might be covering areas that usually have little or no activity. In the post-Sept. 11 world, we need to watch more key areas with more scrutiny and accuracy than before. Entities need either a massive amount of security personnel or they must find a way to automate video surveillance.

The first step toward automated video surveillance is motion detection. Most IP-based cameras now have a simple form of motion detection, as do many digital video recorders (DVR) for analog cameras. This technology works only in areas that should have no traffic, which is usually after operational hours. During the day, security personnel are still staring at a lot of screens. Video analytics was created with the concept of breaking down motion detection to specific types of motion activity. However, new technologies are now being integrated with video analytics to take video surveillance to an entirely new level.

Video-analytics systems from Puretech, Nice, Adventura Technologies, and others usually consist of high-power servers or local dedicated video processing boards in the cameras to analyze pull video feeds from analog or IP-based video cameras. Most require feeds of 7.5 frames per second (fps) or better and run in CIF mode — 352 by 288 resolution, roughly equivalent to a TV set. The CIF resolution is typically limited by processor power of the video processing card and the CPUs of the video processor server. Make no mistake; video analytics will use all the horse power, memory, and bus bandwidth of even the biggest multiprocessor servers. The more rules applied to a screen, the more main CPU horsepower is needed. Throw in large quantities

of hard-drive storage, and analytics requires some investment. Fortunately, Intel and Advanced Micro Devices (AMD) decided that everyone needs multiprocessor capability; and the costs keep coming down. Hard-drive storage is also increasing at an amazing rate with 1 terabyte hard drives available at local electronics stores.

Most IP-based systems can support Motion JPEG or MPEG-4 video protocols. The differences between the two protocols aren't that important on wired or fiber systems, but become important in limited bandwidth environments such as wireless. MPEG-4 can use significantly less bandwidth. A master workstation allows an administrator to create the type of rules and environments that the video-analytics system has to monitor. Rules are what separate motion detection from video analytics.

Follow the Rules

An operator can define an area within a video screen to be the monitored zone. For example, if a camera view is looking at a front yard and that area also includes the street in the view, an operator can create a cutoff point at the curb so that any motion in the street is ignored instead of having to readjust the camera. This allows for irregular areas with any shape to be defined such as curved driveways, round objects, etc.

Most systems can tell the difference between a human, an animal, and a vehicle. This is where the operator starts defining what to watch for. In a yard, the operator might want to know if any children step out of the yard. If a street is at the top of the screen, a rule can detect human motion that goes north and crosses the boundary area, then create an alarm condition that calls the parent to tell them that junior has left the yard.

To ensure nobody enters the yard, we create a similar rule that says if a human crosses the boundary line moving from north to south, then that creates a different type of alarm that might call 9-1-1 to say that an intruder has entered the property. Additional detail in the rules may also be created on some systems say that if somebody less than 5 feet tall enters the yard, that's not an alarm condition because that may be another kid. If somebody more than 5 feet enters, then that's an alarm condition because the rules determine it's an adult.

Video analytics adds a powerful tool to surveillance. Rules for surveillance can range from vehicles going faster or slower than certain speeds, vehicles over certain sizes, and vehicles changing directions in an irregular pattern. Add in the ability to discern the difference between different types of vehicles, cars on runways where only airplanes should be, airplanes over certain sizes on the wrong runways, and humans in areas that should only have vehicles, and the technology can easily alleviate live monitoring needs. In most cases, monitors only come on when an alert is created.

How it Saves Lives

Video Analytics

Furthers motion detection, allowing automated surveillance for specific activities such as vehicles in unauthorized locations and unattended luggage

Applications for Analytics

Video analytics has been applied for security around water tanks. Recent events have shown that water tanks are a known target for theft, vandalism, and acts of terror. By using a citywide long-range wireless mesh system to backhaul the cameras, one city's system monitors 16 water tanks with 48 cameras without requiring full-time operators to see the cameras. Upgrades to the system will include mobile operators who will be alerted with short clips of the event that triggered the alert and real-time access to the cameras at any time across an area of 140 square miles.

Current video-analytics technologies are also capable of watching for unusual activity. A good example is luggage in an airport. If someone leaves a suitcase unattended, a video-analytics system can tell that a human is not near an object that was moving and is now unattended. Guns can also be picked out because of their profiles. Abhorrent behavior such as quick human movement or two humans suddenly connected as if they were fighting can also be detected. However, give someone a hug, and it's a little hard for the system to tell the difference. The technology is still being developed, but it's getting better.

Advanced video-analytics systems can also pick up occurrences that might easily miss the human eye such as a sniper near an airport. Snipers are trained to move inches at a time and could take hours to set up a shot. If they are camouflaged, a normal surveillance operator might never see the sniper. A video-analytics system is patient enough to sense movements of inches over hours.

Video-analytics systems can also be integrated with other alarm systems. A fence sensor alert might be integrated so that a pan, tilt, zoom (PTZ) camera can zoom down to that area. A keypad entry point might trigger a camera to take a facial snapshot when people enter an area. This facial picture then might be used to track a person's movement on the premises.

Challenges and Developments

As amazing as video analytics is, it's still in its infancy in its ability to handle high-resolution images. The horse-power requirements for the video processor cards are brutal. A video processor card that can handle eight cameras at CIF can only handle two cameras at 4 CIF (704 by 576 pixels). Because the cards are fairly expensive and need four times more processing power from the main CPU/CPUs, megapixel video analytics aren't in the near future.

However, this can easily be overcome with most PTZ cameras with optical zoom capabilities of 32 times or more.

Next-generation video analytics are already coming out of the labs to be integrated into existing systems. Tracking a moving car to spot a license plate or a face is already being implemented in dedicated systems. Scientists have identified and created software that can tell the mood of a person. A video-analytics system could conceivably monitor a crowd and tell if somebody is angry and requires additional surveillance. Identification of a vehicle based on color and model would take Amber Alerts to a new level. The systems could monitor every car in camera range across an entire city. This same technology could also be applied to facial recognition and tracking. Facial recognition might even be extended to specific eye movement if someone is watching somebody else too intently.

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Integration with other systems is also an area that next-generation video analytics will tap into. For example, public safety can tap any phone call, cellular or landline, with a court order and a terminal in an office, while cellular companies can locate most users within a few feet based on GPS and other capabilities. Why not integrate the two technologies so that when a tap on a cellular phone is created, the video-analytics system can turn on cameras in those areas and track the phone user?

Public safety will probably be the biggest user of the technology, as its need to monitor high-risk areas doesn't always come with sufficient funding for staff. Video-analytics systems can watch city properties to prevent theft or vandalism, or provide safe areas for parks, for example. The technology can provide another level of force multiplication for government agencies and allow them a more efficient use of staff. ■

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