Living on the edge

A trend toward smart cameras results in more efficient, and cheaper, networks

By L. Samuel Pfeifle, editor

The first great problem preventing the widespread application of video surveillance was lack of manpower. Who's going to watch all that video? But that's been largely solved by the newly developed technology and acceptance of video analytics (see accompanying story, page 19), which turns passive cameras into active sensors and gets guards on the streets again.

The second great problem? Well, it's three problems, really, all of them caused by video analytics: cost, scalability and bandwidth. If you want to run analytics, you need to process all that video with software suites that require relatively expensive servers. If you want to add more cameras, you have to add more of those expensive servers. And to get all that video back to the servers, you need a lot of bandwidth.

"There's been a lot of buzz about video analytics," said Mariann McDonagh, vice president of global marketing at Verint, "but because of this processing the reality of having analytics as a pervasive thing, as a real part of a distributed video application, hasn't really been realized."

Well, until recently. Over the past year, a number of camera manufacturers have joined a select few industry leaders and moved analytics and processing to the edge of the network, to the camera itself, creating intelligent cameras that take the place of servers, offer new scalability and require just a fraction of the bandwidth.

"This is going to revolutionize the industry," said Greg Bell, vice president of business development at camera-maker Lumenera.

Intelligent video is more than just video analytics. It includes processing high-resolution images and the capability to downsize giant image files.
— Paul Bodell, IQinVision

"This makes analytics practical for every camera on the enterprise," agreed McDonagh. "It's going to change the way that people look at analytics."

Bell noted that it's not an entirely new concept. Lumenera had been technically doing it for years, designing very specific algorithms to run on cameras and pick up abnormalities in manufacturing runs. "It was very basic," he said. "They weren't as processor intensive, just rudimentary algorithms, the cameras were not asked to do as much."

Pixim's DPS image sensor converts light to a digital signal at each pixel enabling each pixel to have independent, optimized exposure times to deliver accurate video capture in challenging lighting, such as glare, extreme lighting, and strong backlight.

Now, processor speed is such that complicated software can be run on the camera, with only alerts or specific types of information sent back over the network to a central location, where that information can be used in a variety of ways. Many camera makers noted that chip-maker Texas Instruments has been agile in working with them to port software directly onto the chip. Another chip-maker, Cradle Technologies, has focused its muti-core digital signal processors exclusively on the surveillance market. Analytics "requires a lot of processing power," said Kourosh Amiri, vice president of marketing at Cradle, "and because there are no standards for the algorithms, programability is a must."

The image sensors are getting better, too, and not just the classic CCD chips. Pixim's all-digital sensors are often combined with analytics on cameras. "The trend we're seeing is that the cameras are getting smarter and smarter," said John Monti, Pixim's vice president of sales and marketing, noting that Pixim's chip conveys 16 bits of RGB data, as opposed to a more traditional eight bits. "There's more information to mine ... which makes [analytic] algorithms work better."

But video analytics, what people typically think of when they think of intelligent video, isn't the only thing that makes cameras intelligent, said Paul Bodell, vice president of sales and marketing at IQinVision, a company founded on the intelligent camera concept.

First, "You have to do a variety of different things to process high-resolution images," for example. "The way in which you handle that data is different than CCTV type quality," he said. So the first intelligent cameras with security applications cropped and downsized giant images for monitoring, with end users choosing to download full image quality only when necessary—the intelligence was in the chip processing

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the data and enabling end-user interaction.

Now, however, a camera maker like Arecont Vision, marketing the first five-megapixel IP camera, doesn't necessarily call its cameras "intelligent." That's because the definition of smart cameras has progressed significantly.

"The camera becomes intelligent," said Fredrik Nilsson, general manager at Axis Communications, by way of definition, "when it extracts information from the video and transmits that to the end user instead of just the video itself." He views motion detection as the most basic form of intelligence, positing that most analytic algorithms are essentially high-falutin' forms of motion detection, at a very basic level.

Clara Conti, chief executive officer at iPix, defines an intelligent camera as one that's processing, identifying and tracking objects in real time.

Clara Conti, chief executive officer at camera-maker iPix, "would define it as a sensor that's processing, tracking and identifying objects in real-time, as specified by an end user. If it's doing it automatically, and it's something that's reconfigurable by the end user, I would classify that as intelligent."

Paul Brewer, vice president of new technology and a cofounder of ObjectVideo, whose OnBoard analytics product has allowed a number of camera companies like Lumenera and Verint to make the jump to a suite of intelligence possibilities, leans more toward Conti. "People who are trying to pass off video motion detection as intelligent, I don't think that meets the definition," he said. "You have to get past the pixel change."

Panasonic's SDIII features a newly developed digital signal processor that extracts motion vector, motion area and image sampling data.

Bell said he chose to partner with ObjectVideo because "They are perceived as the market leader for general surveillance analytics. My personal feeling is that there are companies who have a niche that they might be better at, but we've chosen the market leader. They've gone in and focused on solving the challenges of a typical surveillance scene, and written algorithms or rules that the average user is looking for. They've spent dozens if not hundreds of man-years developing these, we're not looking to reinvent the wheel."

Other companies choose to develop their own chips. Panasonic's new SDIII cameras feature "a newly developed [digital signal processor that] extracts motion vector, motion area, edge/frame difference, and image sampling data from the image and sends this data to the new image analysis algorithm," Panasonic Security Systems group marketing manager Julianna Benedick wrote in an email. "The algorithm is embodied in the proprietary microprocessor that performs the complex processing required by SDIII's intelligent functions."

Similarly, Sony recently released the Sony Network Camera line, featuring three cameras that offer forms of motion detection and object detection, all developed in house. "In the conventional motion detection," noted Sean Matsuoka, Sony marketing manager, "the camera does the analysis for the last two frames, we do the last 15 frames, which gets rid of false alarms caused by glare, water and trees ... Compared to the conventional DVR system, which takes up a lot of processing in a central location, there's less burden on the central location if processing is done on the edge."

"The big advantage is that when I'm capturing the video I'm doing the processing on the camera at the same time," said Peter Linzteris, product manager for Verint's intelligent edge device line, agreeing with Matsuoka. "Let's say you have a system deployed today, and you're capturing the video and then transmitting all the video all they way back to the server, using expensive servers to do all the computing. That's very expensive."

"From the integrator's perspective, the scalability of a system is severely challenged when you do central processing," said IQinVision's Bodell. He noted a facial recognition analytic company, Cognitec, who put their algorithm on an IQinVision camera. "The first step is to find the face in the crowd, then differentiate one face from another. If you have that camera streaming video full time, you have to have a dedicated [server] for each camera to handle that processing ... but if you move face-finding to the camera, now instead of that [server] finding the faces, that filtering is done at the edge of the network. Now instead of one camera per server they could have hundreds of cameras per [server].

"It's a lot easier to sell the concept of deploying 50 cameras and one server, instead of 50 cameras and 50 servers. It really enables scalabilty of a system."

An innovator in the IP camera market, releasing its first IP model in 1996, Axis recently stuck its toe in the intelligent-camera market with a camera equipped with the Texas Instruments chip that in Axis' case can be loaded with people counting software, so that the camera counts the people and simply sends the number on a periodic basis back to the end user, drastically decreasing the bandwidth necessary to employ the function on a network.

This sort of thing, said Lumenera's Bell, "just wasn't available in the analog world. We just see this as a critical piece to managing large-scale video systems." That's why cameras will continue to get smarter. SSN