Smart Megapixel IP Cameras make Intelligent Video a Reality

Intelligent Video (IV) systems have been a round for a while and come in a variety of shapes and sizes from basic Video Motion Detector to sophisticated object tracking and face recognition. The more sophisticated algorithms are talked about frequently in the industry due to aggressive sales and marketing campaigns but by-and-large are not being widely deployed in commercial applications due to cost and perceived reliability.

The high cost of traditional IV systems is due to the way they were architected. Until recently IV systems were comprised of a low-resolution (NTSC/PAL/D1) camera connected, via a video-capture card to a PC that was often repackaged to look industrial. To get enough "pixels-on-target" for the IV algorithm to work effectively often required several cameras which each required their own capture card. Dealing with multiple capture cards, or capture cards with multiple inputs, taxed the processing capabilities of the PC so systems could only be deployed with a few cameras-per-PC making the IV system an expensive option.

The reliability of traditional IV systems is due to the way they were architected. Whether IV is deployed as a basic Video Motion Detector or sophisticated object tracking system, they all require the same input, video. Like most systems, the quality of the output of an IV system depends on quality of the input. Over the last year several IV algorithms have come under fire for not delivering perfect results but the IV software was not necessarily to blame. Many of the IV algorithms being deployed or pilot tested today are the results of dozens, even hundreds of man-years of development. They are extremely robust and highly reliable when the input source is of high quality, but garbage in=garbage out.

IV algorithms are designed to work with the data provided by the pixels in the imager of a video source like a camera. All cameras take raw pixel data and condition it so that when it is presented to the human eye, typically on a monitor, it is familiar to the viewer. Most IV products do not care about things like color correction or other image conditioning techniques used to convert those pixels to a presentable image but nevertheless, IV systems are forced to work with these altered images which is often the cause of less than perfect results.

In most cases the video information that the IV system has to operate on is considerably different from what is delivered by the imager in the camera. A tradition IV system worked like this; the raw pixel data from the analog CCD imager is converted to digital data (loss of data) to be processed by the circuitry in the camera (loss of data) and converted to analog (loss of data) to be transmitted via an analog cable (loss of data) to the capture card. From there the analog signal is digitized (loss of data) so the computer can process it. Phew, finally, the IV algorithm can run on the video but the video information it is forced to work with is dramatically different from what came off the imager.

More recently some IV products were designed to work with true digital CMOS IP cameras. The output of the CMOS imager is digital so they eliminate the step, and data

loss, of converting the pixel data to digital, which is a good thing. Ideally you would send that raw pixel data digitally to a PC for processing and eliminate further conversions that result in data loss but that is not practical. Raw pixel data takes up huge amounts of bandwidth and IP based systems need to transmit the images over a TCP/IP network which has bandwidth limitations, especially when you are sending multiple video streams over the networks. The Band-Aid was to perform the same image manipulation in the camera (loss of data) then compress the images (loss of data) and stream them to the PC over an IP connection. So once again, the robust, well-designed IV algorithms are forced to work with low quality images.

Recently however, smart megapixel IP camera manufacturers like IQinVision have offered IV system developers an alternative to the traditional system architecture that addresses both cost and reliability.

As explained above, the high cost of IV systems is due to a thirst for lots of pixels-on-target and with traditional low-resolution images (NTSC/PAL/D1) you needed several cameras to achieve the desired pixels-on-target density. But with the introduction of products like the multi-megapixel IQeye, IV developers could have as many pixels as they want delivered by a single camera.

Smart megapixel IP cameras also allow IV system developers to use the intelligence of the camera to save cost and improve accuracy by moving some of the intelligence to the camera, or distributing the IV processing.

The cost savings comes from scalability. In the example above, the IV PC was forced to process all video from the cameras, which challenged its capabilities and meant that a single PC could only handle a few cameras. Alternatively, if you instruct the smart megapixel IP camera to only send video when it detects a certain type of motion then the PC is not wasting it processor on meaningless video, the net result is that PC can now process images from a LOT more cameras thus reducing the overall system cost by requiring fewer PCs.

Or consider a face recognition system. Most face recognition systems use a PC (or multiple PCs) to process video streams from ‘dumb” cameras, look for a face, convert that face to a template and compare that template against a database of templates. This is computationally intensive and in some instances requires a PC or “face-finding” box-per-camera, expensive. A smart megapixel IP camera, on the other hand, could be programmed to find the face, extract that face and forward it to a PC for template conversion and database comparison. Now the Face

Recognition PC can sit there waiting for faces to be delivered to it and could handle hundreds of cameras-per-pc.

Smart megapixel IP cameras improve accuracy by allowing the IV algorithm developers to access the raw, uncorrupted imager pixel data, from millions of pixels, right in the camera, and perform their analysis. This enables them to analyze pure data and select the information they need from that data to run their IV algorithm.

As IV systems evolve to a distributed processing architecture utilizing smart megapixel IP cameras in which some, or all, of the intelligence is in the camera you will see these systems more widely used as the cost and reliability will be significantly improved.

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