The Power of H.264
Compression's next generation is now

By Michael Korkin, Ph.D.

Arecont Vision LLC, Altadena, Calif., the manufacturer of megapixel surveillance cameras, has solved a problem that has been slowing down the acceptance of megapixel cameras by the security industry. The problem is related to the very essence of megapixel video technology: high image resolution.

Even when compressed to about 5 to 10 percent its original size using the standard MJPEG compression technology, the megapixel video stream needs large disk storage space and a significant network bandwidth.

A superior video compression technology, MPEG, has been available in low-resolution cameras for years. The latest version of MPEG known as H.264 or MPEG-4 (Part 10) was recently finalized by the International

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Telecommunication Union (ITU) in cooperation with ISO/IEC. It offers a significant stream reduction over MJPEG, as well as the earlier MPEG versions, such as MPEG-2 and MPEG-4 (Part 2). The bottom line–the size of video stream compressed by H.264 could be reduced by as much as 20 times over an MJPEG-compressed stream with no sacrifice in video quality.

However, the significant benefits of H.264 come at a cost. There's a multi-fold increase in computational complexity of the H.264 encoder over MJPEG. The increase in computational complexity limits the initial applications of the new standard to less cost-sensitive products, such as broadcast HDTV equipment and to mass consumer products, such as handheld HDTV camcorders.

Because HDTV solutions target the specific video format 1920 x 1080, they are unsuitable for megapixel surveillance cameras that come in a much broader range of video formats and resolutions. Arecont Vision's line of IP cameras includes 1.3-, 2-, 3- and 5-Megapixel models, as well as a dual-sensor 3/1.3 day/night model and two quad-sensor 4 x2- megapixel panoramic models.

In 2006 the company made a strategic decision to undertake the development of a fully proprietary H.264

Arecont Vision will soon deliver H.264 compression in its cameras.

encoder which would support the entire product line of its megapixel IP cameras across the full range of video formats, frame rates and resolutions. In addtion, the H.264 encoder had to support MJPEG as an option and multi-streaming: a simultaneous transmission of several H.264 video streams at different video formats, frame rates and/or resolutions.

Arecont's main challenge was to deliver the H.264 technology at a low cost to ultimately bring down the price of megapixel IP cameras to the level of legacy low-resolution analog and digital cameras that still dominate the security industry. This has been a difficult task given the computational complexity of the standard, but certain cost reduction opportunities are built into the H.264 standard itself – its overall complexity is distributed over a large number of alternative computational options that could be custom mixed and matched for a specific set of application requirements and budgets.

FPGA-based processing

Arecont's proprietary H.264 encoder implemented on a single FPGA-based hardware image processing delivers 80 billion operations per second, a feat that would require 25 Pentium computers to match, while the additional power consumption is only 2 Watts. Despite the low cost implementation, the compression improvement (stream size reduction) at high video quality in a typical street surveillance scene with moving vehicles and people is up to 20 times over MJPEG. This level of compression would be impossible in our low-cost implementation without a proprietary nonlinear temporal pre-encoder which brings Arecont's H.264 performance to the level of more expensive solutions that would be impractical in a surveillance camera. As a result, a 3 Megapixel video stream at 20 fps can get as low as 2 Mbps and take only 20 to 30 gigabytes of storage per day.

Arecont Vision began sampling the new camera models in January and will start full-scale production of the single- and dual-sensor cameras in April 2008.

Michael Korkin, Ph.D. is the director of Engineering for Arecont Vision LLC