Pegasus Imaging – Technical Bulletin

JPEG 2000 – Part 2 - 3D Slice Encoding of Volumetric Data

Part 2 of the JPEG 2000 standard includes features that can be used to encode volumetric data more efficiently than encoding each slice of data independently. Pegasus Imaging Corporation has implemented Part 2 of the JPEG 2000 standard as a new opcode within the PICTools™ MedX Advanced Medical Imaging toolkit. PICTools offer a low-level programming interface, and are written in C/C++ for optimal speed and portability. Because of their high speed and reliability, PICTools compression/decompression technologies have been integrated into many of the leading medical imaging products on the market today.

The new opcode enables numerous image slices to be encoded together into a single JPEG 2000 Part 2 3D image file. The output JPEG 2000 compressed image can be stored in either a DICOM-compatible JPEG 2000 raw codestream format, or in the JPEG 2000 JPX file format. Because the images remain in JPEG 2000 format, image thumbnails can still be retrieved for each of the slices encoded in the file.

The number of slices to encode is determined by the number of partitions provided. Each partition carries the data for one slice and can contain either interleaved RGB samples (8 bits per sample; 24 bits per pixel) or grayscale samples (up to 16 bits). Although color-mapped images are not supported, the ability to compress RGB frames is believed to be unique to the Pegasus Imaging implementation.

The opcode first performs a one-dimensional wavelet transform across all of the slices and then a two-dimensional wavelet transform is performed within each slice. For RGB data, a color transform is performed prior to the one-dimensional wavelet transform. All partitions must have identical characteristics, and therefore must carry the same values in their region structures. In order to meet limitations set by the JPEG 2000 standard, a maximum of 16,384 grayscale partitions, or 5,461 RGB partitions, is allowed.

The degree of overall compression can be controlled by…

1. selecting either lossy or lossless compression, and
2. setting the target number of bits per pixel per slice,
3. setting the target compressed total file size, or
4. setting the target PSNR per slice.

Pegasus has also recently introduced a full-featured JPEG 2000 Transcoder that can directly perform many operations on images without expanding and recompressing them. Full-featured trials of the entire set of PICTools MedX opcodes for still images and video, including compression libraries for lossy JPEG, lossless JPEG, JPEG 2000, JPIP, and JPEG-LS, can be downloaded for evaluation purposes by visiting our Web site, www.pegasusimaging.com, and filling out a simple evaluation agreement.