

Multimedia Systems Lecture 5

LECTURER

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JPEG Compression

- ▶ JPEG stands for Joint Photographic Experts Group.
- ▶ It is a lossy image compression standard which uses Discrete Cosine Transform (DCT) to compress images.
- ▶ It uses the following steps:
 - ▶ Shifting pixel values by subtracting 128 from each pixel value.
 - ▶ Divide image to 8 by 8 block and apply DCT on each block.
 - ▶ Quantize each block using a quantization matrix.
 - ▶ Encode the results of quantization.

Shifting and DCT

- ▶ The shifting is done easily using the minus operator applied to the image's matrix.
- ▶ After shifting the values of each pixel ranges from -128 to 127.
- ▶ Applying DCT is done using the blkproc function as follows:
 - ▶ blkproc is used to apply a function to all blocks of an image it has the following parameters
 - ▶ $B = \text{blkproc}(A, [m \ n], \text{fun})$
 - ▶ A is the original image, m and n are the block's dimensions and fun is the function handle to execute.
 - ▶ This function expects as input a m by n matrix and returns a matrix, vector or a scalar.
 - ▶ $B = \text{blkproc}(A, [8 \ 8], @\text{dct});$

Quantization

- ▶ Quantization is the source of loss in JPEG images.
- ▶ Each 8 by 8 block is quantized to produce another 8 by 8 block which contains mostly zeros in place of the higher frequency components, which makes coding easier.
- ▶ A special quantization matrix is used which has large numbers in lower right corner and small ones in upper left corner.
- ▶ A scale is multiplied by the quantization matrix to represent the quality of images.
- ▶ The value of scale is between 0 (lowest quality) and 1 (highest quality)

Coding

- ▶ We convert each resulting block to a column and apply ZigZag reordering to it.
- ▶ ZigZag tries to put the lower frequency components first and the higher frequency components which corresponds to zero at last.
- ▶ This makes coding easier because the last zeros are all replaced with End Of Block (EOB) byte.
- ▶ We do the conversion using `im2col` function as follows `im2col(A, [8 8], 'distinct');`
- ▶ We use the function `mat2huff` to code the results.

JPEG Decompression

- ▶ JPEG files are decompressed in the reverse order of compression.
- ▶ Decompression follows the following steps:
 - ▶ We use huff2mat to do reverse Huffman coding.
 - ▶ We reconstruct the 8 by 8 blocks with help from the EOB value.
 - ▶ We do dequantization where the values of each block are multiplied by the quantization matrix taking the scale's value in consideration.
 - ▶ We do reverse DCT.
 - ▶ We shift the pixel values again to restore original values in the range of 0 to 255.

Good Luck