CS6351 November 3, 2022
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Homework 4
Due Date: December 1, 2022

In this assignment, you will investigate the effect of the block size on the dct-based compression, in a somewhat simplified way. Turn in your code (program) as an appendix in your homework.

Consider an $N \times M$ image G, to be processed block-wise where every block is $n \times n$, where different values of $n$ will be tried: $n = 4, 8, 16, 32, 64$.

1. Modify your code of the last problem of homework 3 to do the following:
    a. Apply dct2 on $n \times n$ blocks of G; (hint: change [8,8] to [n,n] in blockproc)
    b. Quantize all the DC terms of all the blocks as one data set, using a uniform 8-level quantizer in the range from $\lfloor \min(DC\ terms) \rfloor$ to $\lceil \max(DC\ term) \rceil$;
    c. Order the AC terms within each block in a counter-diagonal zigzag form;
    d. Among all the AC terms across all the blocks, let L=$\lfloor \min(AC\ terms) \rfloor$, and let H=$\lceil \max(AC\ term) \rceil$;
    e. Within each block, quantize the first floor($\frac{n^2-1}{10}$) AC terms with a 4-level uniform quantizer of the range [L, H), then quantize the next floor($\frac{n^2-1}{10}$) AC terms with a 2-level uniform quantizer of the range [L, H), and zero out all the remaining AC terms;
    f. Reconstruct the image by dequantizing the quantized values, and then applying block-wise idct2
    g. Compute the compression ratio and the SNR.
2. For each $n = 4, 8, 16, 32, 64$, apply your code of part (1) on the grayscale version of the River image you used in Homework 3, recording the SNR. You obtain 6 SNR's, 6 compression ratios, and 6 reconstructed images. Note: If the dimensions of the image are not multiples of 64, remove a minimum number of rows from the bottom of the image, and a minimum number of columns from the right, so the dimensions become multiples of 64.
3. Display the original image and the 6 reconstructed images, with clear caption.
4. Graph the SNR's as a function of $n$. Which block size gives the best SNR?
5. Repeat 2-4 on image Lake.