**CS517 Lab\_Image\_Compression**

For this CS517 programming assignment, use the images from this dataset : http://r0k.us/graphics/kodak/ Convert to grayscale using inbuilt matlab or python function, if needed. (Use zero padding if at all there is need for padding on the last column/rows side) In addition to the dataset, use images as uploaded on Google drive.

Analysis table to be based on all 24 images but you may show in report just some sample images.

**Part 1: JPEG Compression**

For analysis, you can choose to vary : no. of Coefficient parameters sent, subimage/block size, Normalization/quantization matrix etc.

By default, consider all coefficients sent unless sequence of zeroes encountered, 8x8 size block size and use standard quantization matrix as provided in book / lecture slides.

It is recommended to use color image jpeg compression by applying RGB -> YUV (or say, YCbCr) conversion as mentioned in slides and you may also refer <https://en.wikipedia.org/wiki/YUV>

For PSNR calculations (in case of color images), use RGB color space only.

For other block sizes quantization matrix (as needed for analysis), resize standard quantization matrix and use rounded integer values. Mention clearly the obtained quantization matrices.

For no. of coefficient parameters variation, use 1 (i.e. only 1 coefficient sent only), 3, 6, 10, 15, 28 and all in zigzag ordering. Consider 8x8 block size and standard Q matrix. Show PSNR table for all images and average (+normalized) PSNR variations via graph, considering both grayscale and color images as input. Also show the curves for compression ratio. Try to have a common plot showing both average compression ratio and average PSNR.

Try to prepare the report accordingly.

*Codes:*

JPEG\_encoder:

Input: image filename, block size, # of Coefficient parameters sent, Color/grayscale binary input

Output: JPEG encoded integer array //this shall also be written in some file e.g. img1\_jpgcode.txt

JPEG\_decoder:

Input: all 4 inputs as mentioned above, JPEG encoded integer array,

Output: Reconstructed image, RMSE, PSNR, and compression ratio

Assume the standard Q matrix is known and could be hardcoded.

**Part 2: LZW compression**

For this part, you may consider only grayscale images. In addition to the dataset, use images as uploaded on Google drive.

To make it easier for all of you, ignore the class discussion of considering 7-bit inputs and 8-bit (LZW) codes, assume now input image pixel values are 8-bit only (i.e. range 0-255) and codes are stored by you as short/integers and for mathematical analysis, we will assume code size to be as specified in that part , e.g. 12-bit codes or 10-bit codes

Assume code table size is 4096 by default i.e. 12-bit codes and also assume image is compressed fully i.e. there is no sub-images / block extraction unless specified. If dictionary get filled (e.g. all 12-bit codes are made), then assume no new codes to be added. (Ref: book, slides, [weblink1](https://www.techtarget.com/whatis/definition/LZW-compression), …)

Include in report your analysis on images uploaded on google drive. Compression ratio achieved, entropy, max compression achievable, etc. your observation on some images. Note again: as LZW is lossless, so PSNR etc analysis is not needed.

*Codes:*

LZW\_encoder:

Input: image filename, block size, Codes size //convert to grayscale if input image is color

Output: LZW coded file, max value of any code i.e. used, # of codes, compression ratio

achieved, Avg. length of encoded pixels, Entropy

//LZW coded filename e.g. img1\_lzwcode.txt. (one row for one block and assume first row has 3 integers: height and width values of image and block size)

Assumptions / constraint:

block size will be 4, 8,16, 32, 64, 128, 256. And -1 indicates whole image

Codes size is in bits and is mandatorily greater than 8. E.g. 9, 10, 11, 12, 16

Each block is separately coded (i.e. no impact of one block on other in terms of coding)

LZW\_decoder:

Input: LZW coded filename (Image height, image width info there in file first row)

Output: Reconstructed grayscale image

**Marking scheme (Total marks 25):**

JPEG codes: 10 JPEG report: 5

LZW codes: 7 LZW report: 3

**Deadline: 17th April 2023 (Monday) Assignment to be done individually.**

Filename format information and Form for submission will be provided later