RE50900 - DIPCV - Assignment IV

JPEG Compression

- **Requirements**: The requirements of each assignment of this course at least include a) full document in PDF/Word format with implementation details and difficulties you met, 2) source code and the compiled file (in exe/dmg/sh) and its readme to indicate how to launch it, and 3) key comments in your source code. If your code was referred from an existing source on the Internet, please cite it accordingly. In this assignment, you are allowed to refer to some existing open source but should identify the source and comment on the code segments. Note that the packages CAN NOT be used in this assignment except the visualization functions.

- **JPEG Compression (140 pt):**
- **Dataset: standard_test_images.zip**
- **Common Requirements**
    1. (40pt) Implement the grey level JPEG compression algorithm with your own "encode" and "decoder", which the bitstream can be unrecognizable by standard image viewers like "paint.exe" or XnView or something like that. Please calculate the "RMSE and "PSNR" between the decompressed and original images, and show two examples in the report.
    2. (20pt) Implement the color level JPEG compression with "4:2:0" color sampling. In this term, the bitstream can be unrecognizable by OS as well.
    3. (20pt) Now ew can compress the image based on the default quantization table. In this subsection, please design a mechanism called "Quality factor" that can control the output quality by changing the quantization table dynamically. Please refer to http://www.robertstocker.co.uk/jpeg/jpeg_new_10.htm for more details.
    4. (30pt) Implement the full-functional JPEG compression (works with both grey and color) with the standard bitstream, where your encoder can generate the bitstream that the OS can be recognized. To do so, you need to understand the file header first. [1][2]
    5. (30pt) As we may know that the Huffman table can be embedded into the Header of the encoded bitstream (file-stream) to achieve a better compression ratio when it is wroth. Please implement this and the encoded bitstream should be able to be recognizable by OS.

- **References**:

[1] https://en.wikipedia.org/wiki/JPEG_File_Interchange_Format
[2] https://yasoob.me/posts/understanding-and-writing-jpeg-decoder-in-python/