GROUP PROJECT—JPEG

CS 443/543, Spring 2019

Important Dates:

Demo & Presentation: in class on 4/23/2019
Report and Source code: before class on 4/23/2019

You may implement this project individually or as a group having up to 3 members (undergrad). **However, graduate students (or ones who registered for CS543) should work on this project alone.**

Project Description

The goal of this project is to implement the lossy compression part of the JPEG algorithm. Implement and apply the following simplified JPEG algorithm for three images in HW1_sample.images.zip. All of the following techniques are covered by Chapter 8 and 9.

Step I: **Compression**

1. Convert RGB components to YCbCr components (you can use Matlab function rgb2ycbcr() or HW2.).
2. Perform chroma subsampling 4:2:0 on color components (HW3).
3. Apply 2D DCT transform (***N = M = 8***) on Y, Cb, and Cr components
4. Apply quantization using quantization tables (Table 9.1 and Table 9.2 of the Chap9 slide) for Luminance and Chrominance components respectively. (i.e., remove AC components–check Chap. 9 slide or textbook.)

Step II: **Decompression**

1. Dequantize the DCT coefficients.
2. Apply the 2D IDCT to the dequantized DCT coefficients.
3. Convert YCbCr components to RGB model.

Step III: **Display**

- Display the output frames and save them in .png

Step IV: **Error Computation**

1. Compute the pixel-wise error (difference) between the original frame and output frame and display the error using imagesc() or (any other way you can do with your language)
2. Compute the Peak Signal-to-Noise Ratio (*I* is the original frame and *I'* is the output frame).

$$MSE = \frac{1}{MN}\sum_{y=1}^{M}\sum_{x=1}^{N}\left[I(x,y) - I'(x,y)\right]^2$$

$$PSNR = 20 * \log_{10}\frac{255}{\sqrt{MSE}}$$

Step V: **Group Report**

- You should show values of the first 8x8 block of the input and output pictures for each stage at both Step I and II; you have to show how the values of the 8x8 block are changed according to different stages.
- You should include input (three different input pictures from HW1_files.zip) and output pictures for each stage at both Step I and II. So you need to display your intermediate results at each stage.
- Describe your observations of the results at each stage at Step I and II; discuss comparisons between the original image and your final output image.
- Create a table including all the results from Step IV; and also discuss findings from this table.
- Lastly, your report should also includes a) Names of group members with the leader and b) responsibilities/ contributions of group members.

Submission
You should submit the following materials for the grading. The user should be provided an option of inputting images to your program.

- Source code with general description (readme.txt) of your implementation and how to run your program.
- All output files in png
- A report
- Include everything in a zip file and the filename of the zip file should include last names of all team members.

Presentation (on 4/23)

- Make slides including the following topics
    - Findings from the project
    - Implementation notes or codes
    - Difficulties and challenges
    - Breakdown of Work
    - Demonstration of your code

Group Project Policy: Typically, all members of a team receive the same project scores, except for clear occasions. Report any team problems to the instructor early, so something can be done to remedy the situation before it is too late.

1. You are responsible for choosing group members.
2. Each group must choose a leader. The leader is responsible for the management of the group.
3. Each group needs to maintain how many times they met, group members who attended the meeting, dates of the meetings, and problems solved. If a group member misses a meeting, s/he should let me know as soon as possible if s/he has any excuse.
4. All group members should contribute the assignment effectively. Normally, all group members will get the same grade for their assignment. However, if there are complaints about some members, not all group members get the same grade.