CS3570 Introduction to Multimedia Technology

Homework #1

Due: 11:59pm, 3/30/2023

1. Color Quantization and Dithering (40%)

(a) Perform the median-cut color quantization to transform the given 24-bit color image (Lena image) to an n-bit color image. You need to find the index colors and construct the Look-Up-Table for the bit-reduced color quantization. Show the color-quantized image and compute the color quantization MSE (mean-square-error) error. Perform the above operation for n=3 and 6 and discuss the results.

(b) With the above color quantization (n=3 and 6), apply the diffusion dithering technique to transform the original image to the bit-reduced color image. Show the dithered color image and compute the color quantization MSE error. Discuss the effect of the dithering technique.

Bonus: You can test the above procedure on different images to show better effect on color quantization and dithering.

2. Interpolation (30%)

Write the image interpolation function to upsample the givenimage to 4 times the original width and height. Implement the following two different interpolation methods and show the 4X (both x and y directions) upsampled image. (You should not use any built-in function for the interpolation.)

(a) Nearest-neighbor (NN) interpolation

(b) Bilinear interpolation

(c) Compare results from (a) & (b). Discuss what you observe.

3. Photo enhancement (30%)

implement the following steps to correct the image “ChangKungLake”. (You cannot use any built-in functions to perform the enhancement procedure)

(a) Convert the RGB color space to YIQ, and show the image histogram of Y channel.

(b) Apply gamma transform to Y channel with a suitable gamma value.

(c) Convert the transformed image from YIQ color space back to RGB to show the result with the best gamma value. Also show the histogram of Y channel for the transformed image.

(d) Compare the image and histogram before and after your enhancement. Discuss what you observed.

Reminder

- **You should not use any function which can generate the result directly in each steps.**
- **Your code should display and output your results so that we can judge if your code works correctly.**
- **You should provide a README file about your execution instructions**
- **Please compress your code, input images, result images, report and README in a zip file named HW1_{Student-ID}.zip and upload it to eeclass.**
- **If you encounter any problem, please post your problems/questions on eeclass.**
- **Please follow the file structure below:**

```
.
└── HW1_111062547
    ├── 1.py
    ├── 2.py
    ├── 3.py
    ├── README
    ├── img  -> The image program need
    │   ├── Lenna.jpg
    │   ├── bee.jpg
    │   └── lake.jpg
    ├── out  -> output image
    │   ├── Y_hist.jpg
    │   ├── Y_hist_gamma.jpg
    │   ├── bee_linear.jpg
    │   ├── bee_near.jpg
    │   ├── error_diffusion_dithering_3.jpg
    │   ├── error_diffusion_dithering_6.jpg
    │   ├── gamma_img.jpg
    │   ├── median_cut3.jpg
    │   └── median_cut6.jpg
    └── report.pdf

4 directories, 17 files
```