HC701 – Assignment # 1

In this assignment you must implement the following three tasks and submit the code along with a brief report summarizing your findings. You will be able to find the data for each task in the following directory shared directory: (/apps/local/shared/HC701/assessment/assignment_1/). You must submit a PDF for your work.

Task 1: Histogram equalization and counting (3/10 marks)

Write a Python code to load a set of 20 DICOM images. Perform histogram normalization to each image then further normalize the pixel values to range between -1 and 1. Compute the mean pixel intensity for each image. Then multiply negative values with 0.9 and positive values with 0.8. Recompute the mean intensity for each image, sort the means in ascending order and report 20 values. Also report the mean and standard deviation of processing time of images (without including the loading of the image from drive) and report the CPU/RAM spec of the PC you are using.

Task 2: 3D image visualization (3/10 marks)

Task 2.1 (2 marks). Write a Python function to:

- load one brain MRI (default orientation is axial).
- Create a small GUI to allow the user to choose one of the three orientation options. Then based on the selected orientation, visualize slices of the MRI scan one by one automatically with 0.1 second latency when visualizing the next slice.
- Report your code and a screen shot of the interface.

Task 2.2 (1 mark). Use slicer to create a 3D rendering of the lungs only region. Report 2 screenshots of the rendered lungs and a brief description of the process you followed to get the lungs (description must be < 100 words).

Task 3: Image filtering and quality assessment (4/10 marks)

Write a Python code to load a set of 2D+time echocardiography scans provided as 10 video files. You are also given a text file called “Frames.txt” containing the name of each video and the indices of 2 frames within the video (first frame is at position zero). You need to perform the following:

Task 3.1 (1.5 marks): Compute PSNR between the two frames on each video. Report the code and the name of the video with the highest PSNR.

Task 3.2 (2.5 marks): Improve the quality on the frame only (the second frame mentioned in Frames.txt) in each video by

- Filtering the frame using different filtering methods such as median, Gaussian, etc.… (minimum 3 different filtering methods).
- Compute PSNR between the original frame and the filtered frame on each video.
- Report your code and the experiments you did. Discuss briefly which filtering method provided the best PSNR and why?

Task 1

Code

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Brief description

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Results or screen shots

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