

**Instructions:**

- The homework should be submitted via ‘Microsoft Teams’. No other modes of submission will be accepted. The due date for the submission is 29<sup>th</sup> Sep 2022 (Thursday), 3:30 PM.
- A single ZIP file (‘name-ds261-hw1.zip’) should be uploaded. The file should contain all codes and a latex generated report. Please use ‘Python’ to complete the assigned tasks. You can use inbuilt functions.
- The dataset to be used for this homework has been posted in ‘Microsoft Teams’. It consists of COVID-19 CT Scans and Infection Masks ( $\sim 3500$  scans from 70 Patients). For more details regarding the dataset visit [\[here\]](#). The infection mask should be read as 0 - background, 1 - infection, and 2 - healthy.

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**Q1****1 points**

Use the given expert annotations (infection masks) and categorize the CT scans into three categories: Normal, Mild, and Severe. Report the dataset distribution (or count) of above mentioned classes. Also, display a sample for each category’s infection mask and infection rate. [Hint : For a given slice, Normal : infection rate is 0%, Mild : infection rate is (0%, 40%] and Severe : infection rate is  $> 40\%$ ].

**Q2****2 points**

Apply the K-Means algorithm on the given CT Scans for segmenting the infected and healthy regions of the lung tissue. Compare the predicted mask from K-Means with expert annotation and report the averaged dice score, sensitivity, specificity, and accuracy for the normal and infected regions. Also, display two sample slices along with the expert infection mask and predicted mask.

**Q3****2 points**

Reconstruct the given CT Scans from limited angle Sinograms (4x and 8x) and report the averaged quality metrics PSNR and SSIM for the limited angle reconstructions. Also, display a sample slice along with 4x and 8x reconstruction. Repeat Q2 on the limited angle CT reconstructed data.

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