

Instructions:

- The homework should be submitted via ‘Microsoft Teams’. No other modes of submission will be accepted. The due date for the submission is 15th Dec 2022 (Thursday), 3:30 PM.
- A single ZIP file (‘name-ds261-hw3.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’ (refer to the homework 1 folder).

Q1**1 points**

Split the CT slices into 70% training, 10% validation and 20% testing. Train a UNet model to segment the given CT slices into background-0, COVID anomaly-1, and normal-2 regions. Report the sensitivity, specificity, accuracy, and Dice scores for the classes 1 and 2. Display a sample slice along with the predicted and original masks. Mention if you have used any data pre-processing and augmentation.

Q2**2 points**

Data Sensitivity: Reconstruct the CT scans (test cases used in Q1) from limited angle sinograms (4x and 8x). Using the trained model from Q1 predict the segmentation masks of the reconstructed test cases. Also, report the sensitivity, specificity, accuracy, and Dice scores for the classes 1 and 2. Display a sample slice along with 4x and 8x reconstruction with the generated mask and the original mask.

Q3**2 points**

Model Sensitivity: Perturb the parameters ($\theta = \theta + \eta\% \theta$) of the trained model from Q1 and predict the segmentation masks of test cases used in Q1. Report the sensitivity, specificity, accuracy, and Dice scores for the classes 1 and 2. Experiment with $\eta = [-0.01, -0.001, +0.001, +0.01]$ and compute the pixel-wise uncertainty of predictions. Check whether it correlates with errors. Display a sample slice for each experiment along with the predicted masks, original masks, and the uncertainty map.
