

AIMIA

Homework 3

Abhishek Kumar Chaudhary

December 15, 2022

Problem 1:

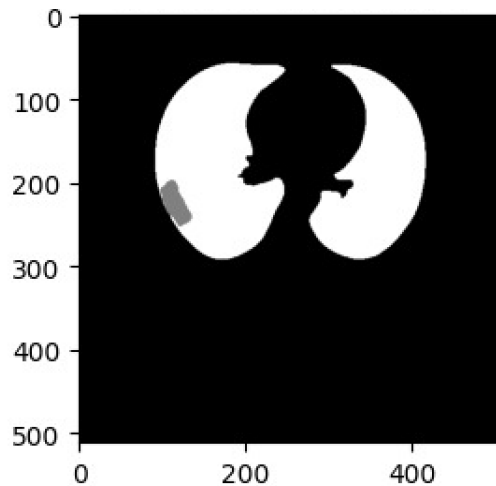
Using UNet model to segment the given CT slices into background-0, COVID anomaly-1, and normal-2 regions. Sensitivity, specificity, accuracy, and Dice scores for the class 1(Infection) and class 2(Healthy):

Table 1: Results from Unet segmentation

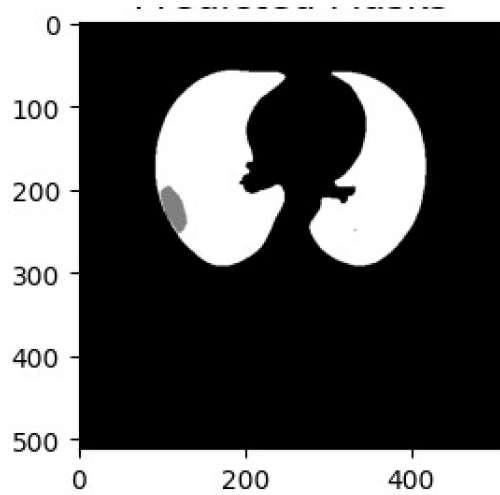
Results	Class-1	Class-2
Dice Score	0.463	0.971
Sensitivity	0.931	0.953
Specificity	0.981	0.986
Accuracy	0.983	0.982

Sample slice along with the predicted and original masks:

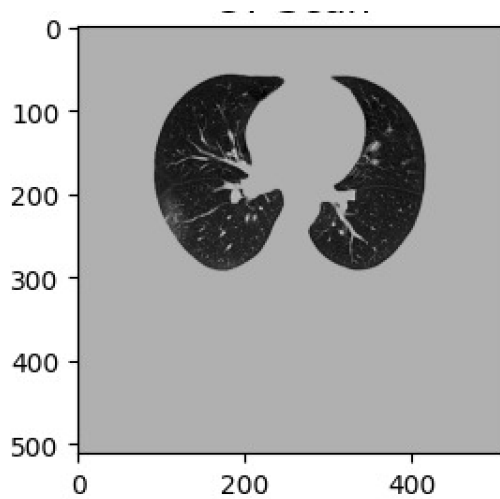
Expert annotation:



Predicted annotation:



CT scan:



Problem 2:

Data sensitivity:

Reconstruct the CT scans (test cases used in Q1) from limited angle sinograms (4x and 8x).

Sample 4x,8x,reconstruction:

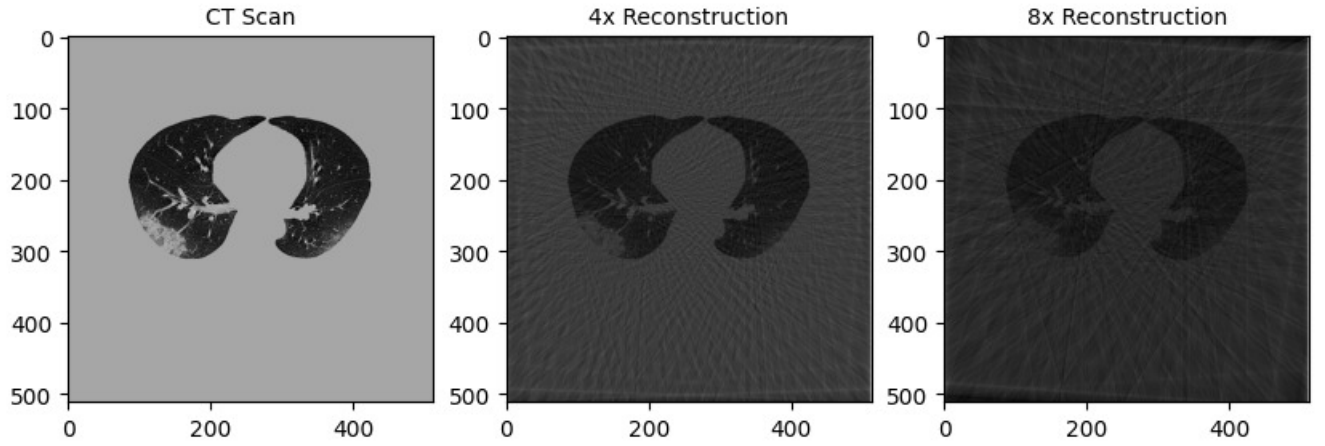


Table 2: PSNR & SSIM for Reconstructed CT Scan Images

Results	4x Reconstruction	8x Reconstruction
PSNR	14.771	8.372
SSIM	0.289	0.143

Image Segmentation on 4x reconstruction using trained UNet:

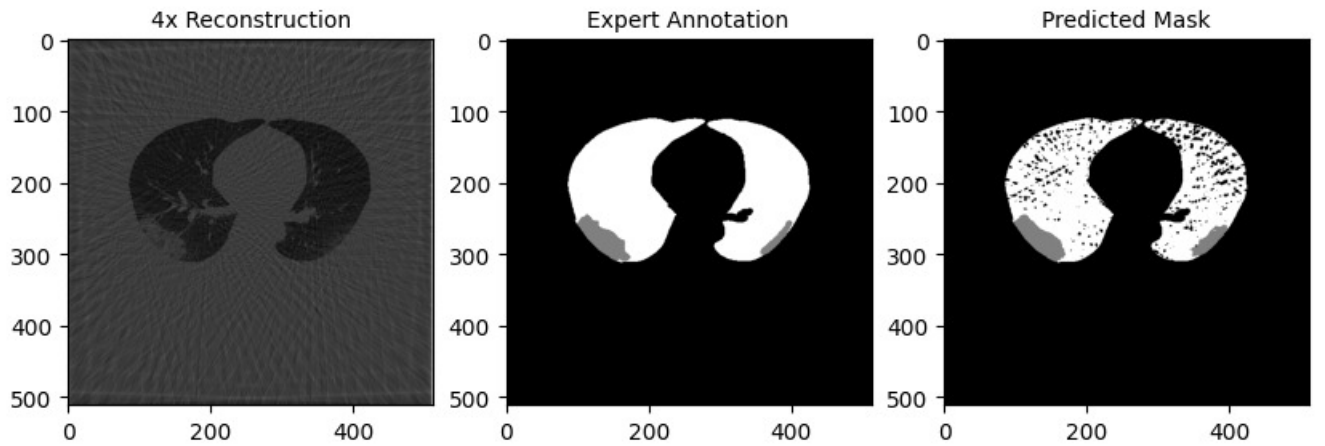
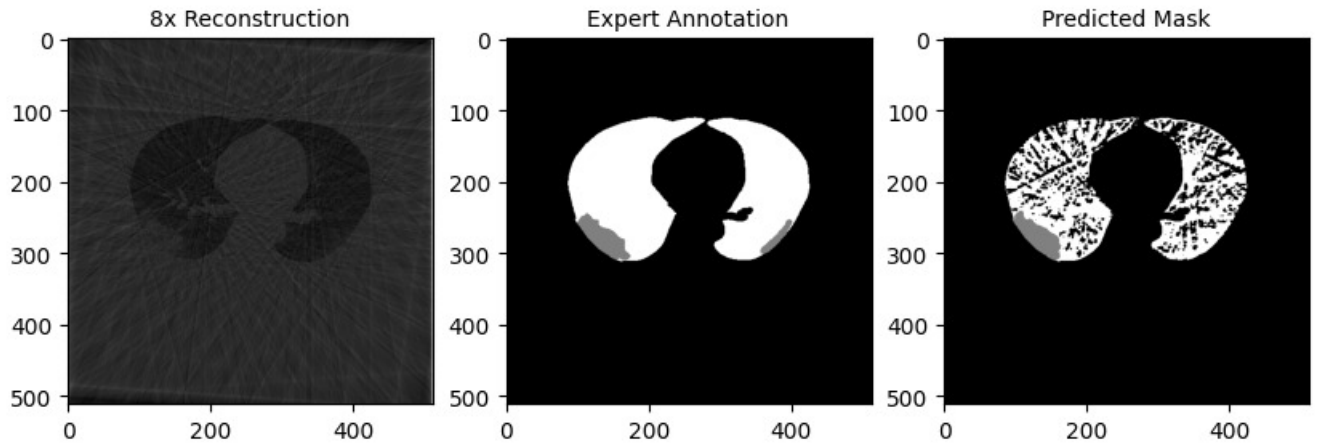


Image Segmentation on 8x reconstruction using trained UNet:



Metrics for 4x and 8x reconstruction:

(i) 4x Reconstruction

Table 3: Results metrics

Results	Infection Region	Healthy Region
Dice Score	0.223	0.841
Sensitivity	0.962	0.799
Specificity	0.692	0.982
Accuracy	0.677	0.941

(ii) 8x Reconstruction

Table 4: Results metrics

Results	Infection Region	Healthy Region
Dice Score	0.152	0.792
Sensitivity	0.796	0.798
Specificity	0.431	0.874
Accuracy	0.435	0.871

Problem 3:

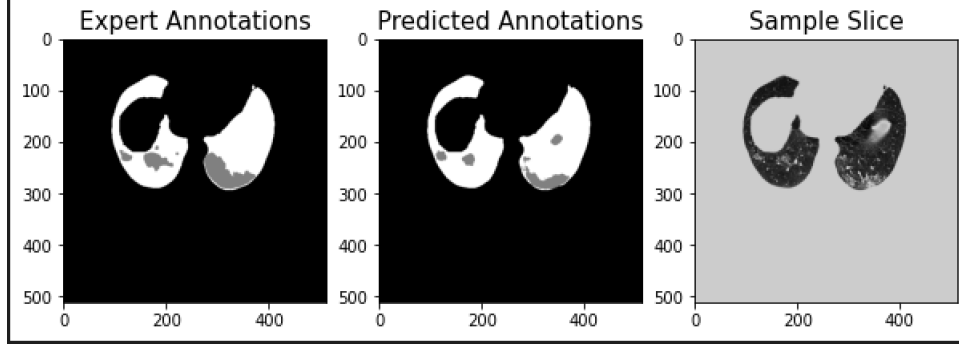
Model Sensitivity:

$$\eta = -0.01:$$

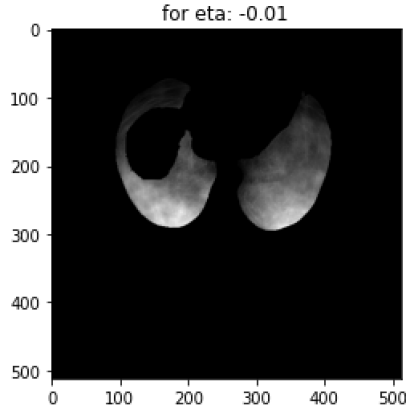
Table 5: Results metrics

Results	Infection Region	Healthy Region
Dice Score	0.437	0.963
Sensitivity	0.941	0.945
Specificity	0.991	0.997
Accuracy	0.986	0.992

CT scan, expert annotated mask & the output of perturbed UNet on the slice:



Pixel-wise uncertainty map:

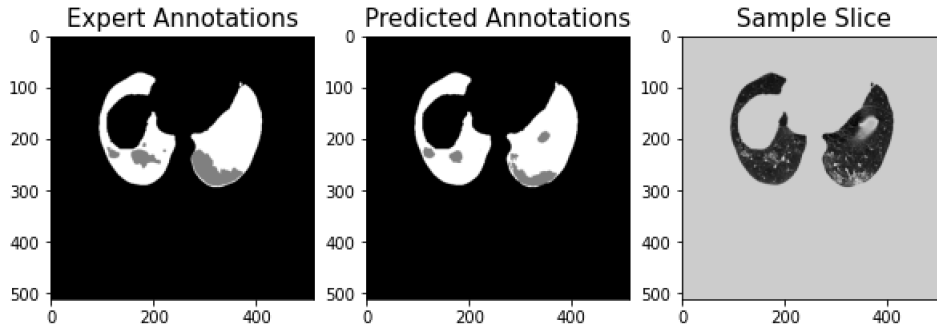


$\eta = -0.001$:

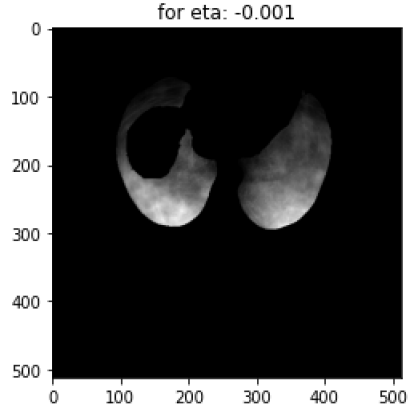
Table 6: Results metrics

Results	Infection Region	Healthy Region
Dice Score	0.437	0.961
Sensitivity	0.941	0.943
Specificity	0.991	0.987
Accuracy	0.989	0.992

CT scan, expert annotated mask & the output of perturbed UNet on the slice:



Pixel-wise uncertainty map:

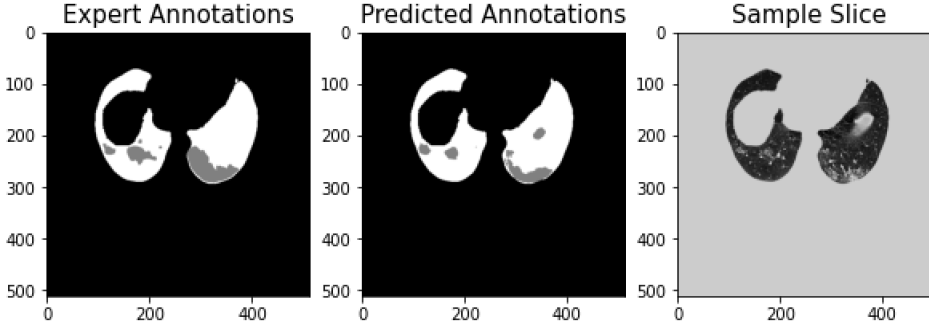


$\eta = 0.001$:

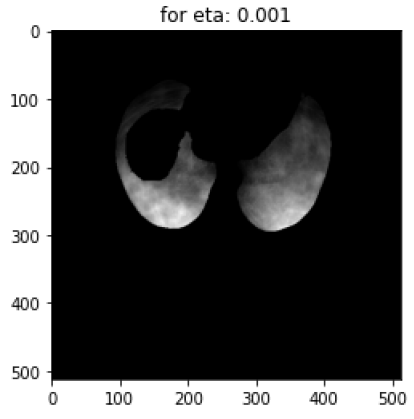
Table 7: Results metrics

Results	Infection Region	Healthy Region
Dice Score	0.437	0.961
Sensitivity	0.942	0.943
Specificity	0.992	0.987
Accuracy	0.989	0.991

CT scan, expert annotated mask & the output of perturbed UNet on the slice:



Pixel-wise uncertainty map:

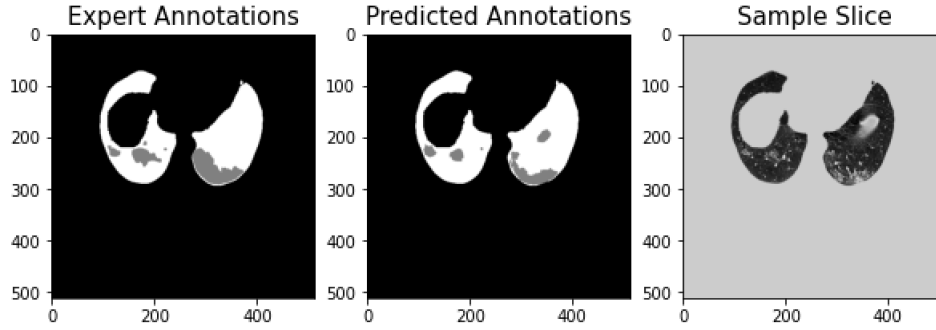


$\eta = 0.01$:

Table 8: Results metrics

Results	Infection Region	Healthy Region
Dice Score	0.445	0.968
Sensitivity	0.932	0.961
Specificity	0.994	0.989
Accuracy	0.995	0.993

CT scan, expert annotated mask & the output of perturbed UNet on the slice:



Pixel-wise uncertainty map:

