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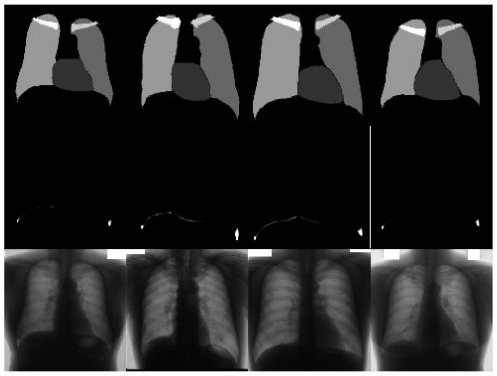
Course: CM2003 Deep Learning Methods for Medical Image Analysis

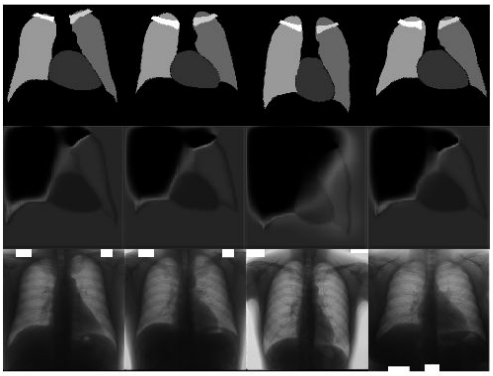
Laboratory Assignment 6

Task 1: pix2pix – from segmentation masks to X-ray images

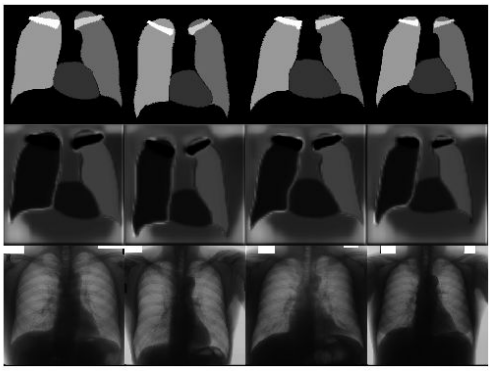
In this task, several tests have been performed by changing the values of the number of epochs and the loss weight. The obtained images are shown:

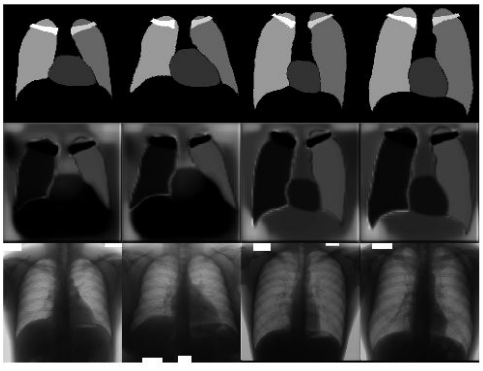
- Epochs = 100 Loss_weight = 1,1



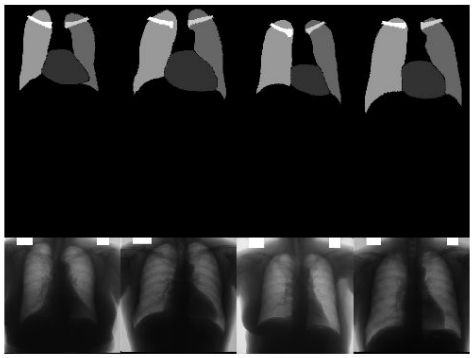


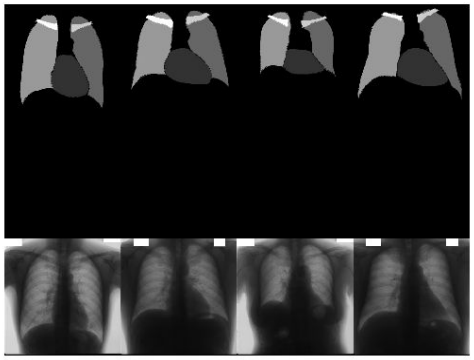
- Epochs = 50 Loss_weight = 1,1



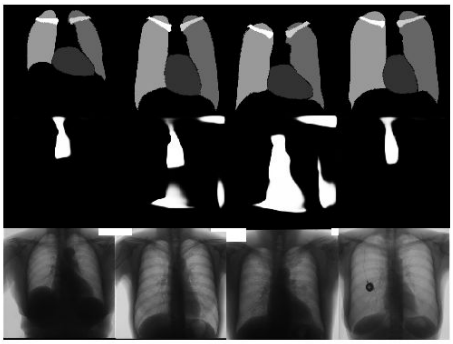


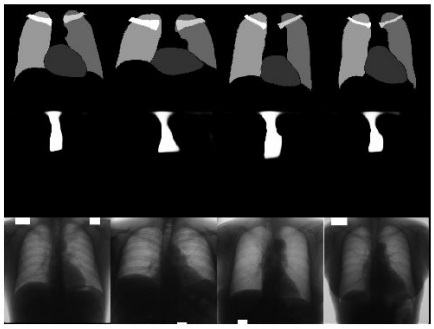
- Epoch = 50 Loss_weight = 1,2





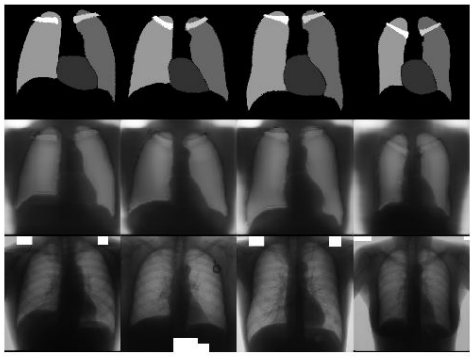
- Epoch = 50 Loss_weight = 2,2

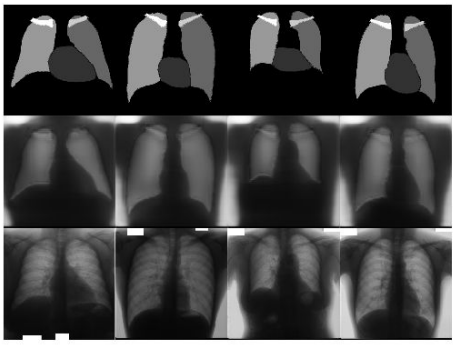




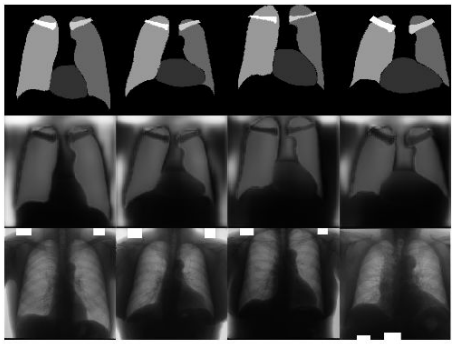
- Epoch = 50

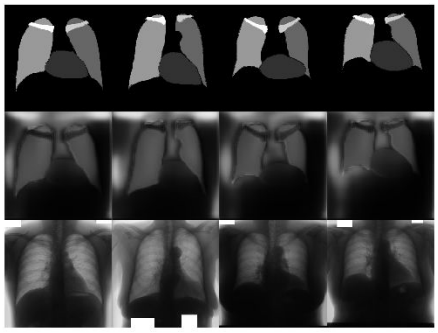
Loss_weight = 2,1





- Epoch = 50 Loss_weight = [3,1]





Conclusion: After having performed different experiments changing the number of epochs and loss weight we have observed that having a higher number of epochs does not necessarily mean an improvement of the final result. As per the loss weight, it is very important to assign the right value so that the network learns the right parameters. In the images, it can be observed that when assigning different weight values the obtained result varies considerably.

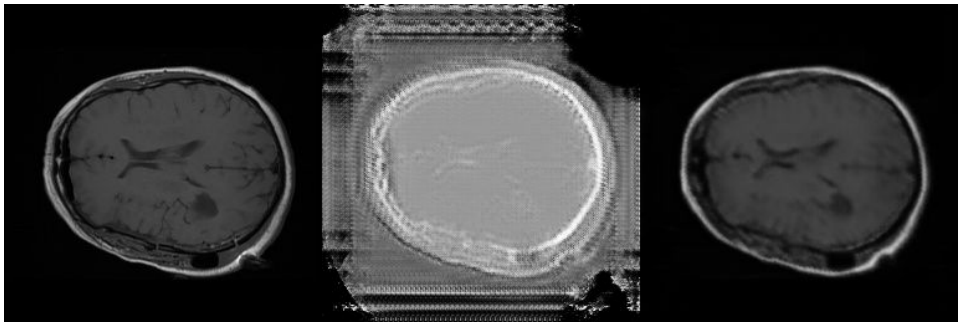
Task 2: CycleGAN – from CT to MRI, and vice versa

For testing the effect that the different parameters of the configuration of CycleGAN have, we have performed 4 different tests by changing different parameter configurations. This way we are able to see how these changes will affect the predictions of the CycleGAN. In the following description of the tests, there are two pictures attached (A test, B test), those correspond to the test data to perform the task to translate from MRI to CT images.

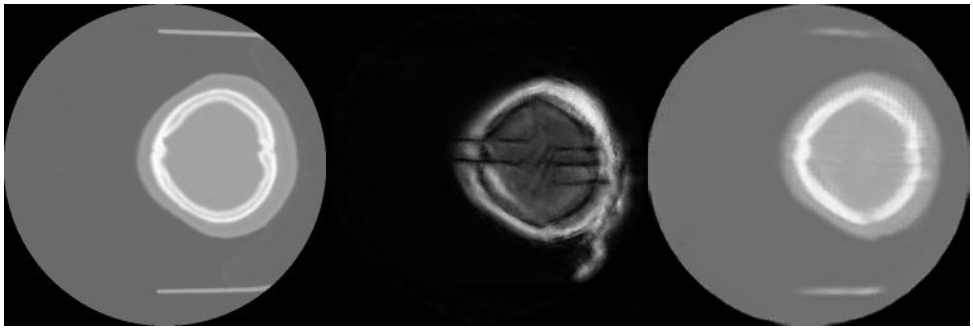
- Original parameters

```
self.lambda_1 = 10.0  # Cyclic loss weight A_2_B
self.lambda_2 = 10.0  # Cyclic loss weight B_2_A
self.lambda_D = 10  # Weight for loss from discriminator guess on synthetic images
self.epochs = 25  # choose multiples of 25 since the models are saved each 25th epoch
```

A test



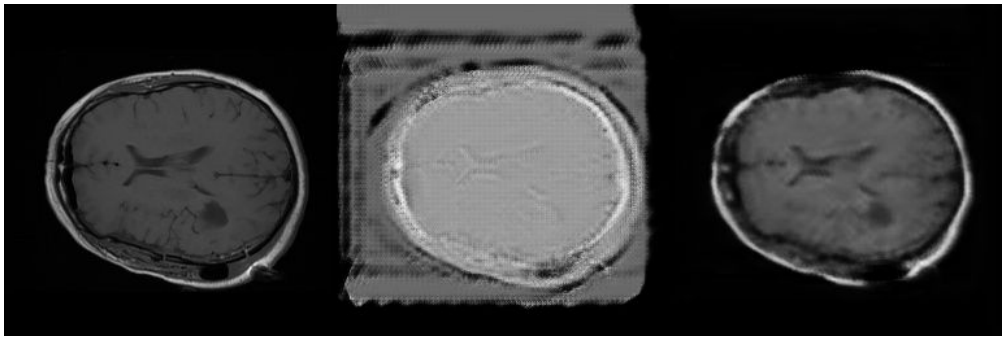
B test



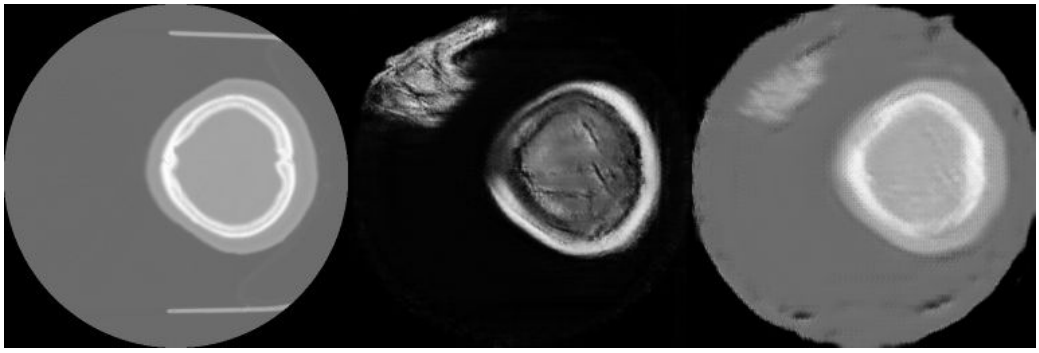
- Test 1

self.lambda_1 = 20.0 # Cyclic loss weight A_2_B
self.lambda_2 = 10.0 # Cyclic loss weight B_2_A
self.lambda_D = 10 # Weight for loss from discriminator guess on synthetic images
self.epochs = 25 # choose multiples of 25 since the models are saved each 25th epoch

A test



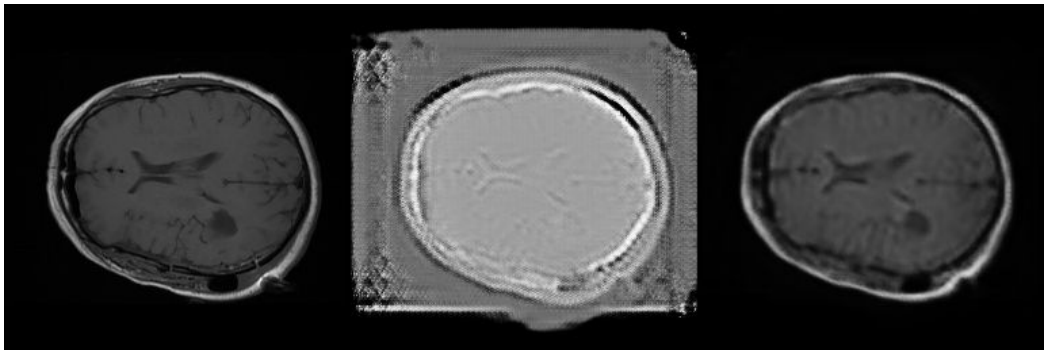
B test



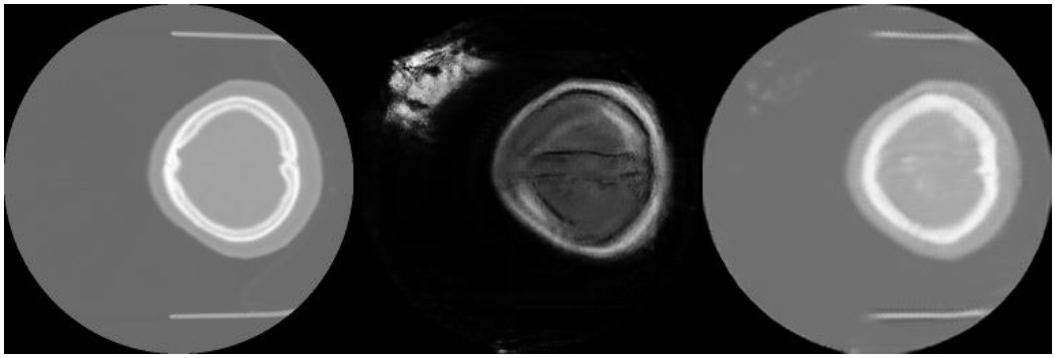
- Test 2

self.lambda_1 = 10.0 # Cyclic loss weight A_2_B
self.lambda_2 = 20.0 # Cyclic loss weight B_2_A
self.lambda_D = 10 # Weight for loss from discriminator guess on synthetic images
self.epochs = 25 # choose multiples of 25 since the models are saved each 25th epoch

A test



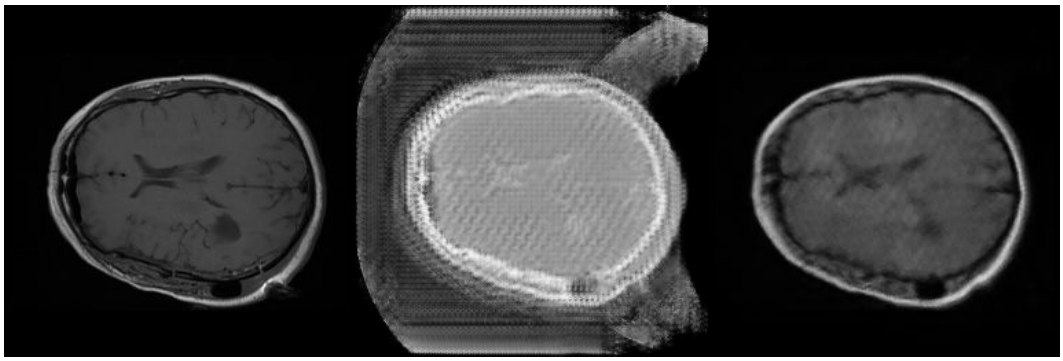
B test



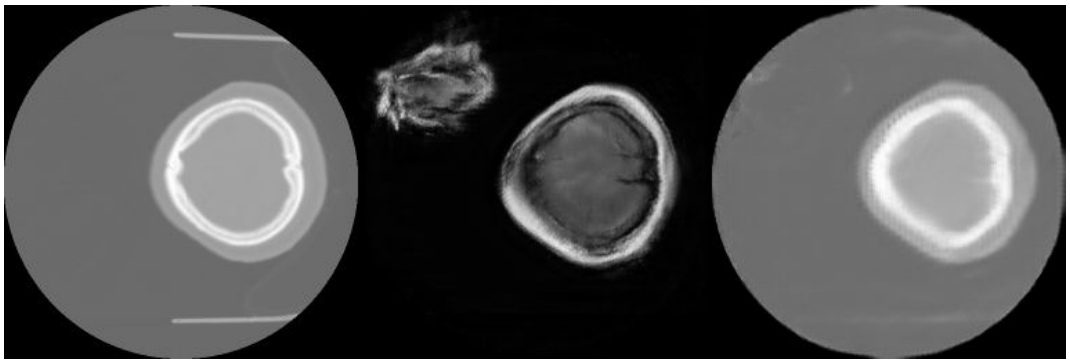
- Test 3

self.lambda_1 = 10.0 # Cyclic loss weight A_2_B
self.lambda_2 = 10.0 # Cyclic loss weight B_2_A
self.lambda_D = 20 # Weight for loss from discriminator guess on synthetic images
self.epochs = 25 # choose multiples of 25 since the models are saved each 25th epoch

A test



B test

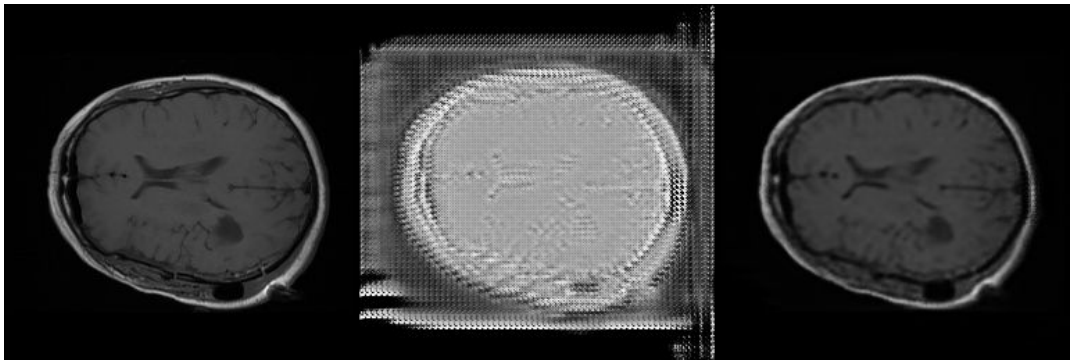


- Test 4

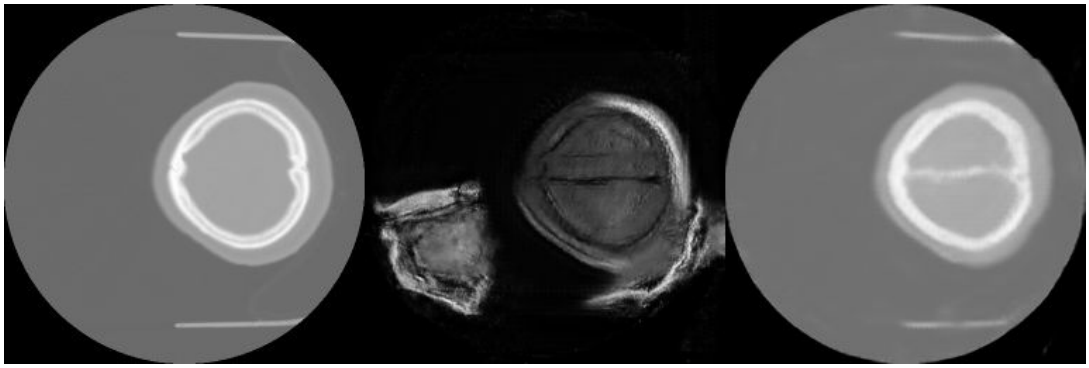
self.lambda_1 = 10.0 # Cyclic loss weight A_2_B

self.lambda_2 = 10.0 # Cyclic loss weight B_2_A
self.lambda_D = 10 # Weight for loss from discriminator guess on synthetic images
self.epochs = 40

A test



B test



Conclusion: When giving a greater weight to the loss of translating from B → A, the translations from CT to MRI are qualitatively better than the predictions from MRI to CT in this case. If the translations from A →B are given a greater weight loss, it can be observed that the predicted result of CT to MRI is not as good as for the previous configuration. However, the translation from MRI to CT is not the best one obtained. When increasing the weight of the discriminant network some artifacts appear in the translation. Also when more epochs are used for training the network it can be observed that the translations are much sharper. Finally, it can be concluded that a balanced and accurate weight distribution can contribute to an improvement of the translation quality.