

CS270B Homework 2 (Final Project)

You can choose to do one of the following questions, or you can choose your own topic related to this course as your final project.

For the following question, we provide a data generator to generate data for training purposes. This data generator can generate sinogram domain data in different views to reconstruct 2D images.

- <http://pan.shanghaitech.edu.cn/cloudservice/outerLink/decode?c3Vnb24xNjQ5NTg5MDE0NjM1c3Vnb24=>
- password: cs270b

As with the previous assignment, we provide three levels of difficulty to choose from.

Image Reconstruction on a Sparse View Projection

- Difficulty: ★★☆☆☆

In a traditional CT image reconstruction task, we need 720 directional projections, and use FBP, to produce a detailed, artifact-free image. In this assignment we will find a way to do the reconstruction with sparse view sampling.

Reconstruction under sparse projection

- Difficulty: ★★★★★

In this problem, you need to complete an image reconstruction without artifacts with less than 120 views. We want there are as much detail as possible on your final reconstruction result. You are free to use the groundtruth and supervised methods. The final score will be based on the quality of your reconstruction.

Reconstruction with limited viewing orientation

- Difficulty: ★★★★★

In practice, we often encounter situations where the direction of observation does not cover all directions. In this case you need to complete the task with no more than 2/3 of the observation direction (i.e. 120°) and with no more than 120 views of the image. The final score is mainly based on the quality and completeness of your reconstruction.

Self-supervised training

- Difficulty: + ★

Reconstruction in a self-supervised manner has been a popular topic in recent times. In this question, we will try to complete image reconstruction using a self-supervised approach. Please propose a method to complete the self-supervised training. As with the previous two questions, you will be limited to no more than 120 views for this reconstruction. The final score is based on the quality of your reconstruction.

- Hint: You may use NeRF.

Bonus: Noise and image perturbation

In real CT data, we often encounter noise and image shifting during projection. Based on the model you choose in first three question, add the ability to carry perturbations or resist noise to it. In your report, you need to indicate how you made the data, which real-world situations they match, and compare your final method with your original method in terms of quantity and quality.