CS754 Assignment-3

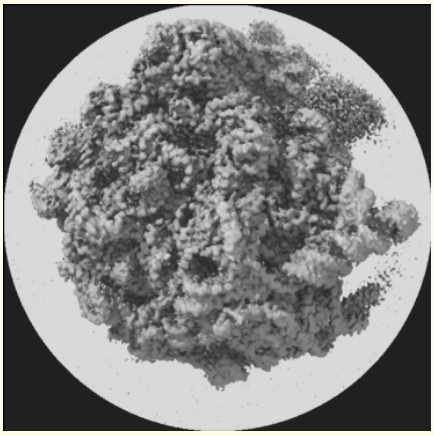
Saksham Rathi, Ekansh Ravi Shankar, Kshitij Vaidya

Declaration: The work submitted is our own, and we have adhered to the principles of academic honesty while completing and submitting this work. We have not referred to any unauthorized sources, and we have not used generative AI tools for the work submitted here.

Question 3

Solution

Here is the original cryoem image:

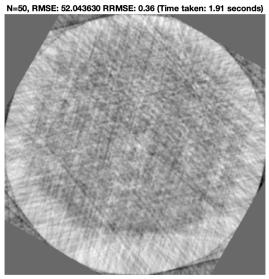


Original Image

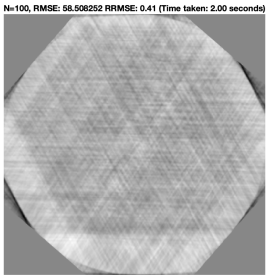
Here are the steps followed:

- Generate random angles in the range [0, 360). (Number of angles decided by N.)
- Find the radon projections of the original image along these angles.
- Build the similarity matrix (using cosine similarity).
- Apply Laplacian eigenmaps to estimate projection angles.
- Normalize the angles, so that they belong to the range [0, 360).
- Reconstruct the image using inverse radon projections.
- Find the optimal rotation (to minimize RRMSE) (the number of angles tried is made to depend on the number of projections, for higher resolution, with the minimum number of angles tried to be 360).

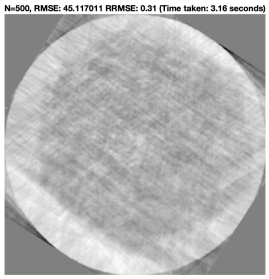
Here are the reconstructed images:



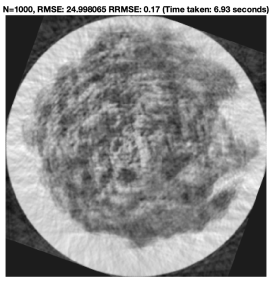
$N = 50$



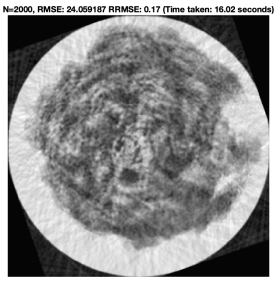
$N = 100$



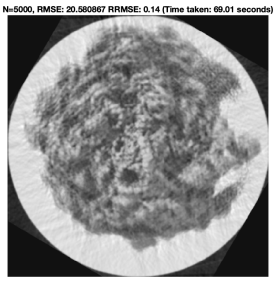
$N = 500$



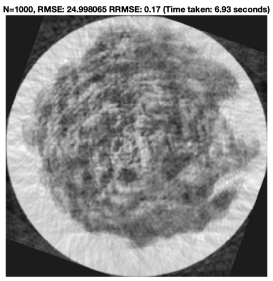
$N = 1000$



$N = 2000$



$N = 5000$



$N = 10000$

Reconstructed image for different values of N

As we can see, the RRMSE (and RMSE) drops as N increases, which is expected, as we are getting data about more number of projections. Moreover, the image looks more similar to the original image.