Homework 1

Submission DDL: 2025/03/02 23:59

Please complete the code in the attachment to accomplish the following tasks. Submit a brief report in English detailing your implementation and experimental results. The report should be in **PDF format**, using any template, but **not exceeding 6 pages**.

1. **(70 points)** Please fit a 2D `ship` image of 512×512 size with implicit neural representations (INR) (also known as coordinate-based MLPs). You are encouraged to replace the cameraman image with any 2D image you like (especially an RGB image). The final results are needed to present, qualitatively and quantitatively (PSNR and SSIM).
   Hint: basic knowledge about INR can refer to [1, 2, 3].

2. **(20 points)** Please show the resulting images represented by INR at several (at least 5) different training epochs and try to describe and explain the phenomenon you observe.

3. **(10 points)** Please implement position encoding [1] and then compare it with Fourier encoding [3] on the model performance (including accuracy and speed).

References

[1] B. Mildenhall, P. P. Srinivasan, M. Tancik, J. T. Barron, R. Ramamoorthi, and R. Ng, "Nerf: Representing scenes as neural radiance fields for view synthesis," *Communications of the ACM*, vol. 65, no. 1, pp. 99–106, 2021.

[2] T. Müller, A. Evans, C. Schied, and A. Keller, "Instant neural graphics primitives with a multiresolution hash encoding," *ACM Transactions on Graphics (ToG)*, vol. 41, no. 4, pp. 1–15, 2022.

[3] M. Tancik, P. Srinivasan, B. Mildenhall, S. Fridovich-Keil, N. Raghavan, U. Singhal, R. Ramamoorthi, J. Barron, and R. Ng, "Fourier features let networks learn high frequency functions in low dimensional domains," *Advances in Neural Information Processing Systems*, vol. 33, pp. 7537–7547, 2020.