

Peer Review

Review of: " ρ -NeRF: Leveraging Attenuation Priors in Neural Radiance Field for 3D Computed Tomography Reconstruction"

Hongjiang Wei¹

1. BME, Shanghai Jiaotong University, China

This paper proposes p-NeRF, a new unsupervised method for 3D sparse-view CT reconstruction. Following NeRF, p-NeRF uses an MLP network to learn the continuous function of unknown CT volumes from sparse-view projections. Benefiting from the continuous representation of MLP networks, high-quality images can be reconstructed. Building upon this, p-NeRF proposes incorporating CT volumes generated by traditional algorithms (e.g., FDK) as initialization to improve CT reconstructions. The paper is well-written and well-structured. The proposed p-NeRF is evaluated on the LIDC-IDRI and scientific visualization datasets. However, in my opinion, the paper is limited in terms of both novelty and impact. Below are my specific comments:

1. There are many studies on the applications of NeRF in sparse-view CT reconstruction. However, the core contribution of the proposed p-NeRF is somewhat trivial. The incorporation of initialization volumes appears to be a form of residual learning, which lacks significant innovation.
2. More importantly, as shown in Figures 3 and 4, the visual differences between p-NeRF and the baselines are very minor and almost negligible. These results do not convincingly demonstrate the effectiveness of the proposed method.
3. In Section 4.3, the authors state that "FDK, being a physics-based algorithm, preserves more attenuation details". However, if projection views are sparse, FDK reconstructions often include more streaking artifacts compared to iterative methods. This claim should be clarified or supported with additional evidence.

4. The evaluation is limited to simulated datasets. For medical applications, evaluation based on in vivo data is necessary to validate the method's practical utility.

To sum up, the contribution and novelty of this paper are both limited. I therefore recommend rejecting this submission.

Declarations

Potential competing interests: No potential competing interests to declare.