Docket #: S21-167

NeRP: Implicit Neural Representation Learning with Prior Embedding for Sparsely Sampled Image Reconstruction and Other Inverse Problems

Stanford scientists have invented an implicit an Neural Representation learning methodology with Prior embedding (NeRP) to reconstruct a computational medical image from sparsely sampled measurements using only a prior image of the subject. Most deep-learning-based image reconstruction algorithms require large-scale training data and externally sampled subjects to be able to recreate a full image from sparsely sampled imaging data. The proposed NeRP framework exploits prior knowledge from a previous image of the same subject to serve as the initialization for the image search, allowing a multi-layer perceptron model trained on subsampled images (i.e., projection space sampling for CT or frequency space sampling for MRI) to reconstruct the full image, significantly speeding up data acquisition time. This technology would find use in a number of medical imaging use cases, including serial images of cancer patients over time, for which the inventors have demonstrated that the program can assess subtle changes in tumor progression over time.

Applications

- **Accelerated image acquisition** and **simplified hardware design for:**
  - Tomographic imaging (CT)
  - Magnetic resonance imaging (MRI)
  - Other image modalities for which reconstruction can be formulated as an inverse problem

Advantages

- No large-scale data is required to train
- Applicable to multiple different imaging modalities (MRI, CT, and more)
- Robust, reliable, and able to capture relatively small changes in images over time

Publications

- Shen, L., Pauly, J., & Xing, L. (2021). NeRP: Implicit Neural Representation Learning with Prior Embedding for Sparsely Sampled Image Reconstruction. arXiv preprint arXiv:2108.10991.

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