Implicit Neural Representation for nondestructive imaging

Internship Offer - LIRIS - Origami team, (Univ Lyon 1, France)

Advisors: Julie Digne (julie.digne@liris.cnrs.fr), Nicolas Bonneel (nicolas.bonneel@liris.cnrs.fr)

Context:

Implicit Neural Representation [1,2,] are powerful techniques to reconstruct shapes or render scenes from different viewpoints [3]. They use a single neural network to represent a function in the ambient space, function that serves for rendering the scene, or to extract the final shape. While these methods initially suffered from high computation times, fast variants have been developed allowing to train these representations in a few seconds [4].

Goal:

In this internship, we will explore how implicit neural representation can be used for nondestructive imaging, such as for medical imaging or archaeological imaging. The goal is to reconstruct relevant organs from a sparse set of projections of an acquired volume. To do that, we will develop dedicated regularization techniques for handling data sparsity and possible measurement noise.

As a secondary goal, we will explore how these representations can help the later segmentation of the acquired objects into different parts for example.

Applications:

We target a medical image application when we only do a few measurements and archeology.

Required skills: geometry processing, machine learning, optimization

Languages: Python/pytorch

Advisors: Julie Digne, Nicolas Bonneel

Location: LIRIS, Origami team, Nautibus building, Univ Lyon 1

Salary: 600€ per month

Duration: 4 to 6 months (starting date anytime between Feb 2022 to April 2022)

References

[1] Park, J. J., Florence, P., Straub, J., Newcombe, R., & Lovegrove, S. (2019). Deepsdf: Learning continuous signed distance functions for shape representation. In Proceedings of the IEEE/CVF conference on computer vision and pattern recognition (pp. 165-174).

[2] Sitzmann, Vincent, Julien Martel, Alexander Bergman, David Lindell, and Gordon Wetzstein. (2020) "Implicit neural representations with periodic activation functions." Advances in Neural Information Processing Systems 33: 7462-7473.

[3] Mildenhall, B., Srinivasan, P. P., Tancik, M., Barron, J. T., Ramamoorthi, R., & Ng, R. (2020). Nerf: Representing scenes as neural radiance fields for view synthesis, In Proceedings ECCV 2020.

[4] Müller, T., Evans, A., Schied, C., & Keller, A. (2022). Instant neural graphics primitives with a multiresolution hash encoding. Siggraph 2022