Biomedical Imaging in the Era of Neural Fields

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Abstract

Biomedical imaging has traditionally relied on voxel- and grid-based representations for various applications using convolutional neural networks. Recent advances in computer vision have introduced a paradigm shift toward continuous, resolution-agnostic models enabled by neural fields. Techniques like Neural Radiance Fields (NeRFs) and Implicit Neural Representations (INRs) have demonstrated great potential in biomedical applications, offering compact, efficient, and highly adaptable data representations that are widely modality agnostic.

This talk explores how neural fields can redefine biomedical imaging by leveraging implicit neural priors to tackle traditional tasks such as registration, reconstruction, super-resolution, shape completion, and segmentation. Particular attention will be given to their emerging role in single-subject learning problems, where conventional deep learning methods often fall short. We will examine how these advancements align with the needs of biomedical applications and discuss challenges in training neural fields, including computational resources, meta learning and comparability.

Biosketch

Julian McGinnis is a PhD student in Computer Science at the Technical University of Munich, focusing on implicit neural representations for medical imaging. He explores neural fields for tasks like image reconstruction and lesion detection and hosted last year's MICCAI tutorial on implicit neural representations for medical imaging.