Neural network surgery: continual learning for patient-specific neural fields

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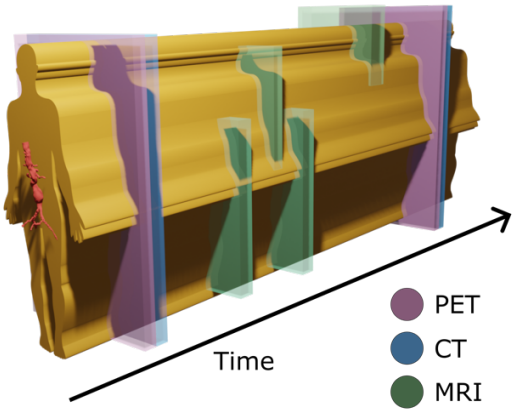
Neural fields, also called implicit neural representations or coordinate networks, are an active research domain in which neural networks are used to represent data continuously on low-dimensional domains[1]. In medical imaging, neural fields have, for example, been used for image reconstruction, image registration[2], or growth modelling. Neural fields have the potential to serve as a general representation for longitudinal patient data by incorporating, e.g., images acquired at different points in time, different imaging modalities, and different scales. However, the use of INRs for this purpose raises several challenges. For example, inclusion of new data is not as straightforward as in more explicit representations like voxel grids or meshes. Adding new data to an already trained neural network might lead to *catastrophic forgetting*. This is a scenario in which a neural network that has been trained to perform some tasks forgets how to perform that task as soon as it is fine-tuned on new data. In this project, you will work on ways to mitigate this problem, e.g., through continual learning strategies such as *Elastic weight consolidation*[3] or *Learning without forgetting*[4]. You will investigate what is needed to develop neural fields that can be edited to add, remove, modify information, without catastrophic forgetting.



Keywords: Continual learning, implicit neural representations, catastrophic forgetting

References

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