Deep learning for automatic surface reconstruction

6 month Internship for an M2 student during the school year 2019-2020
CENIR, ICM, 47 bv de l'hopital Paris 13

The CENIR is the MRI acquisition facility at the ICM with 2 MRI 3T scanners focus on brain images. We optimize the acquisition parameters and propose advanced pre-processing pipeline to improve data quality http://www.cenir.org/.
We have a strong knowledge in MRI physics, and traditional image processing and we have the access on several large database (~ 20 000 subject) of multi-contrast acquisitions.

Subject

Deep learning has been now widely applied in the MRI field, but always considering the MRI volume as a pixel images, neglecting the true nature of 3D MRI volume where pixel have a spatial dimension, and localization.
We aim to develop a machine learning method, to re-construct brain tissue surfaces from several MRI volumetric acquisitions. We want to train the neural network with simulated data from the direct model that predict the voxel intensity value from the precise localization of the surface boundary (this can be simply computed from the partial volume and the intensity value of the 2 structures). Having thus different contrast acquisition will further constrain the solution, even in the case of lower spatial resolution.
The main difficulty will be in the prediction of a high resolution surfaces, we want to explore if Convolutional graph neural networks (http://geometricdeeplearning.com/) can be used to better estimate the solution

Possibility to continue on a Phd if success grant application.

Skill
- Python programming
- Image processing (surfaces and volumetric data)
- Experience in deep learning (graph CNN)

Autonomy and appetite to learn

Contact

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