University of Strasbourg

MSc internship – 2020

Data augmentation for SEEG electrode segmentation using deep learning

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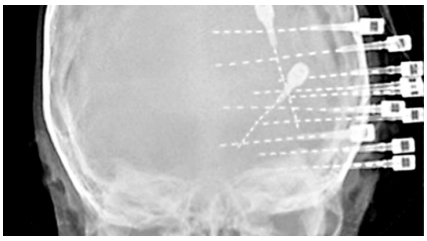
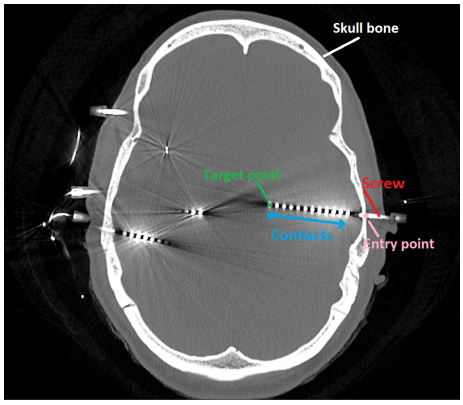
Context :

One of the first steps of the surgical treatment of epilepsy consists in detecting with the best possible accuracy the epileptogenic zone causing the seizures. To achieve this, the surgeon inserts a dozen of electrodes in various parts of the brain to record the neural activity through small metallic contacts along the electrodes. When the electrodes are in place, it is essential to detect these contacts in postoperative images, in order to link a precise position in the brain with the detection of abnormal activity, and prepare the resection of the dysfunctional area.



Work :

In the past few years, methods based on machine learning have known a growing interest in various fields, including medical image processing. During this internship, we would like to take advantage of the power of convolutional neural networks to detect metallic contacts on postoperative CT images. However, these methods require a large amount of training data, but the number of available data is not always sufficient. A classic technique consists in augmenting the available data, either by modifying the existing data or by synthetizing new data.



This work will consist in proposing methods to augment the available data, more particularly by creating synthetic training data. The synthetic data should have a degree of realism that allows for an improvement of the performances of the network in the recognition of the contacts, compared to the original training data. In particular, the synthetic data should show realistic artifacts or interferences, similar to those caused by the presence of metal in the CT images, whatever the position in which the electrodes are placed (possibly close to each other).

The synthetic training data will be tested with two types of networks: a deep convolutional network allowing for a detection of the contacts with a classification approach (FastRCNN architecture), and a U-Net network allowing to segment directly the detected objects. During this internship, a thorough experimental validation phase will have to be conducted, and will be performed using 3DSlicer platform (www.slicer.org) in python or C++. The trainings and segmentations using deep learning will be done in python using the Keras library (keras.io).

Duration of the internship: 6 months, starting January, February, or March 2019.

Profile: MSc with a major in computer science, computer graphics, image processing, or related fields. Proficiency in Python is required.

Stipend: the intern will receive the legal stipend for trainees (around 500€ per month).

For further information and application, please contact the supervisors.