

Automatic tissue segmentation in small animal head

Proposal for a Master's Thesis Topic

Magnetic Resonance (MR) is a non-invasive imaging technology that is among the increasingly popular methods to use in rodents' studies. Analyzing data from this type of study typically walks through a number of necessary steps: a registration step to align all images, a skull-stripping step to remove all non-brain tissues, and segmentation of the head into different regions, e.g., dividing the head image into a set of homogeneous regions. There are a lot of pipelines and tools that can handle all of these steps for humans automatically, such as SPM, FSL, and FreeSurfer, but when applied to rodent scans none of these approaches are directly applicable. While almost all the methods for addressing this problem are computationally expensive and require post-processing segmentation cleaning up by an expert.

Nowadays, artificial intelligence becomes an invaluable tool in neuroscience research. As an important aspect of artificial intelligence in specific, deep learning approach is their ability to perform automatic feature extraction that is helpful to build a model with less machine effort and more learning speed. Due to this, deep learning approaches, such as CNN, allow us to extract the required segmentation from brain images. Here, in this project, we aim to develop a deep-learning model for accurate segmentation of rodent head MRI datasets. In particular, the goals of this project are:

- Analyse rodent brain imaging data
- Develop a model to detect different segmentation tissue in head
- Design a volume conductor model of a rodent head

The following prerequisites will be useful for the project

Experience with / Signal processing, Machine Learning / Deep Learning
knowledge about:

Programming skills: Matlab or Python

Language: English

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