Brain Image Registration Techniques for Connectomics Analysis

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Part of Japan's Brain/MINDS project [1] is to map the brain of the common marmoset (Callithrix jacchus) at the mesoscopic level, where the large-scale patterns of fiber projections are elucidated. In order to carry this out, brain image data must be reconstructed into the correct 3D shape and this talk will discuss methods to do this when the input data is in the form of a set of 2D histological images. Here a 3D MRI volume was used as a reference shape and 2D and 3D registration steps were progressively applied to normalize the data. As a fundamental tool, ANTs and its SyN nonlinear registration algorithm were used to carry out the different registration steps [1][2]. Once this process is completed the data can be mapped in 3D to a standard brain atlas – the atlas was created using the same 2D to 3D reconstruction techniques. Subsequently, for tracer injection studies, these tools can be used as a basis for connectomics analysis.

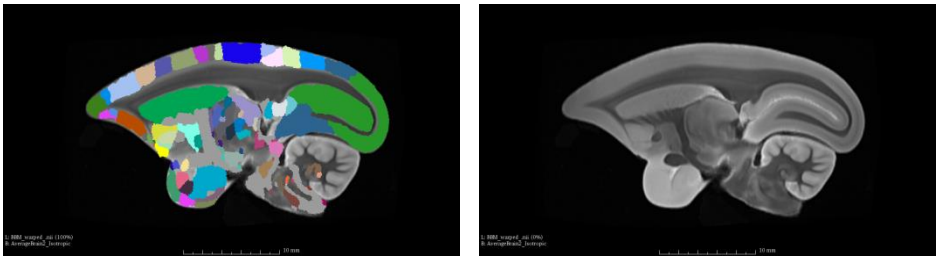

Figure 1: Sagittal view of the brain atlas (left) used in this work mapped with an average MRI brain (right).

I will describe the steps for 3D reconstruction, integration of data to the brain atlas, and discuss what must be completed in the future for the successful processing and integration of a large number of datasets.

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