Winter School - BigBrain data and tools

Wednesday 3 February 2021 - Thursday 4 February 2021 virtual meeting

Program Details

BigBrain anatomy for beginners

Nicola Palomero-Gallagher Feb 3, 8am / 2pm

The goal of this course is to familiarize scientists with no, or only very little, knowledge about brain anatomy with major brain structures and their functions. You will learn about the landmarks used by anatomists to navigate through the brain, and the functions they are involved in. Most importantly, you will have a chance to search for these structures yourselves. By the end of the course you will not only be familiar with terms such as lobes, gyri, diencephalon, hippocampus or visual cortex, but you will also be able to find these structures in the BigBrain dataset.

BigBrain data processing with CBRAIN and DataLad

Petur Helgi Einarsson, Mohammad Shahbaz Memon, Morris Riedel, Tristan Glatard, Valérie Hayot-Sasson, Natacha Beck

Feb 3, 9:10am / 2:10pm part I Feb 3, 10:30am / 4:30pm part II

This tutorial will provide an introduction to two tools that can be used to process and manage BigBrain-related data: CBRAIN and DataLad.

CBRAIN is a web portal that provides seamless access to high-performance computing clusters. DataLad is a data integration tool to keep track of distributed datasets. The tutorial will cover the main functionalities of CBRAIN and DataLad, illustrate them on BigBrain data, and demonstrate their interaction.

BigBrain as part of the European EBRAINS platform

Timo Dickscheid Feb 3, 11:40am / 5:40pm

The EBRAINS multilevel human brain atlas integrates maps that capture different facets of human brain organization into a common framework. It is defined across multiple reference spaces, where BigBrain represents the micrometer level. The atlas links cytoarchitectonic areas with ultra-high resolution BigBrain data, complements them with maps of fibre architecture and functional organization, and links them to a growing set of multimodal data features associated to brain regions. EBRAINS atlas services are designed as an online framework that can be accessed interactively using an online viewer, as well as in a programmatic fashion through structured Python and http interfaces. This tutorial will give a tour of the recent status of EBRAINS atlas services, and discuss some future directions.

Atelier3D-MCIN Tutorial – A software suite for interactive visualization, annotation and mapping of the BigBrain

Louis Borgeat, Philippe Massicotte, Andrea Brandtstetter Feb 3, 1:00pm / 7:00pm

This tutorial will introduce the Atelier3D-MCIN software and utilities, and provide walk troughs of different annotations and mapping applications for the big brain. Atelier3D is a Windows and Linux-based software platform that provides powerful processing and visualization tools for the analysis of very large volume and surface datasets, and this version has been specifically adapted to support 3D annotation, segmentation and 3D surface extraction in the big brain in support of different use cases in McGill and Juelich. The tutorial will cover Installation and basic use of the software for local or remote visualization, and then focus on one or more specific scenarios of interest to the community, in collaboration with actual users of A3D. New and advanced features will also be discussed, including interoperability with other tools and video production.

Integrating BigBrain with MRI using The BigBrain Warp

Boris Bernhardt, Casey Paquola Feb 4, 8am / 2pm

The BigBrain Warp is a toolbox for multi-modal integration of BigBrain, composed of a centralised repository of BigBrain related transformations and scripts to easily move between histological and MRI spaces. In this session, we'll walkthrough the toolbox and guide short tutorials on how to use BigBrain in the context of structural and functional MRI.

Anchoring partial volumetric data to BigBrain using VoluBA

Timo Dickscheid, Sebastian Bludau Feb 4, 9:10am / 3:10pm

VoluBA ("Volumetric Brain Anchoring") is an online service which allows to upload a high-resolution volume of interest (VOI) to perform interactive anchoring to the BigBrain, without the need of downloading the BigBrain volume to a local machine. VoluBA provides fast and intuitive manipulation of the 3D position, orientation, and scale of the VOI. Furthermore, it allows to precisely enter pairs of corresponding 3D landmarks and use them to refine the alignment by 3D affine parameters. In addition, a plugin is available for subsequent nonlinear adjustment of cortical VOIs, which exploits equivolumetric volumetric depth as a constraint in case that a segmentation of the gray matter is available. In this tutorial, we will provide a hands-on introduction to VoluBA, using a real world example dataset.

Algorithms for Segmenting the Brain: From thresholding to deep neural networks

Thomas Funck Feb 4, 10:30am / 4:30pm

This tutorial will give a brief overview and hands on examples for common techniques that can be used to segment brain images. We will start by looking at simple, but powerful, histogram thresholding, before touching on some common machine learning techniques, ending with a look at neural networks. This session is not a deep dive into any of these topics but instead aims to give participants an idea of what tools are available, how to use them, and their limitations. Ideally, participants should have a basic understanding of python, but this is not strictly necessary.

Working with the BigBrain atlas of cortical layers

Konrad Wagstyl Feb 4, 11:40am / 5:40pm

In this session we will work through examples for how to interact with the laminar atlas of the BigBrain using jupyter notebooks and python.

We will cover using the segmented BigBrain volume, mesh surfaces and surface-based maps of laminar thickness and intensity, as well as basic tools for visualising the data.

Collaborative segmentation and analysis of histological data on the Web using MicroDraw

Katja Heue, Roberto Toro, and Nicolas Traut Feb 4, 1pm / 7pm

High resolution histological data provides a unique perspective on the cellular structure of the brain. Histological data is available for a large number of species, and the possibility of staining for particular aspects of the tissue allows the researcher to formulate an extremely rich range of questions. It presents, however, several challenges which make its analysis difficult. In particular, the data is affected by various types of artefact, and the subtle differences that distinguish one structure from the other require a well trained human eye. In addition, scanned at very high resolution, the file sizes involved become difficult to manipulate. These may be in part the reasons why the expert segmentation of histological material is often performed by a single researcher.

MicroDraw is an online tool for the collaborative segmentation of high-resolution histological data. MicroDraw uses deepzoom to enable rapid access to high-resolution data without limits in image size. Images can be manipulated in any Web browser, in computers, tablets or even smart phones. MicroDraw provides a growing number of tools for vectorial annotation, which allow us to segment data at any resolution. MicroDraw greatly simplifies distributed collaboration, by providing researchers access to the same dataset independently of the computer where the data is hosted. MicroDraw provides simple tools for the definition of collaborative projects, and helps coordinate access to data and results. Finally, MicroDraw implements a RESTful API, which allows researchers to programmatically query the segmentations performed in a project and use sophisticated image analysis tools for their analysis.

In this tutorial we will show how to encode data and host it to make it accessible. We will use the

BigBrain data as an example. We will then show how to visualise data and annotate it using the different vectorial annotation tools. We will show how to create a project to centralise a set of annotations. Finally we will show how to query that data using a Python script, display the data obtained and compute some simple measurements.

MicroDraw is open source and we invite you to contribute to its development either as a user or as a developer.