Abstract: The prototype, available for use by members of the HBP Consortium, comprises alpha releases of the following components of the platform: the dataset search, documentation about data standards and HBP-core models, links to tools for the analysis of structural and functional brain data, and access to the HBP Mouse/Rat Brain Atlas and Human Brain Atlas via a 2D Atlas viewer.

Keywords: HBP-core, data integration, search, tools, ontologies
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1. The Aim of this Document

This document provides the information needed to access the Neuroinformatics Platform alpha release - preliminary release for internal Consortium use (Deliverable D5.8.3, Milestone 105).

2. How to Access the HBP Neuroinformatics Platform

The Neuroinformatics Platform alpha release is accessible at the following address: https://nip.humanbrainproject.eu (username: visitor, password: hUm4nbr41n).

The current alpha release of the Platform is a preliminary release for internal Consortium use. If you do not have the necessary login and password, please contact: data.nip@humanbrainproject.eu.

All HBP Platforms will also be accessible via the HBP Collaboratory.

Collaboratory:
https://collab.humanbrainproject.eu/#/collab/19/nav/403
Neuroinformatics Platform on the Collaboratory:
https://collab.humanbrainproject.eu/ - /collab/47/nav/236

3. Overview

The Neuroinformatics Platform homepage gives an overview of datasets that are currently integrated in the HBP KnowledgeGraph, and are accessible through the Search application. The HBP KnowledgeGraph serves as the common data store and provenance tracker for all types of data, models, and literature produced and consumed by other services, tools and Platforms in the HBP. On the Neuroinformatics Platform homepage, users are invited to contribute data, and are provided with a link to request support (see Figure 1 in Annex 2 below). The Navigation bar gives direct links to search, tools released by SP5 and documentation.

4. Help and User Feedback

To contribute data or to provide feedback, please contact: data.nip@humanbrainproject.eu.

User feedback on the expected search criteria will be very valuable. It will help the Platform team to optimise the search application, and ensure that the proper metadata is captured.

The HBP core model is being developed based on W3C PROV. This captures metadata that describe how a dataset was obtained, who contributed to it, and details about the specimen used. Most of the metadata are described by ontologies, allowing comparisons between datasets. Textual and spatial search services are being built based on the metadata to enable data exploration and discovery. Feedback on the methodology and possible ontology extensions would be welcome.
5. Annexes

1) Tools & Features Available in this Platform Release
2) Screenshots of Tools & Features Available in this Platform Release
# Annex 1: Tools & Features Available in this Platform Release

<table>
<thead>
<tr>
<th>Tool / Feature</th>
<th>Responsible</th>
<th>Milestone / Remarks</th>
<th>Keywords</th>
<th>Available at</th>
<th>Description/Screenshot</th>
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<td>WP5.1 Sean HILL</td>
<td>MS87 Alpha version of atlas registration and navigation tools including search of KnowledgeGraph. Tracking of dataset registration.</td>
<td>Search</td>
<td>Search</td>
<td>Brain Atlas Search. Search based on curated metadata</td>
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<td></td>
<td>Registration tracker (Internal use)</td>
<td>Data tracker</td>
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<td>Alpha release of structural analysis tools.</td>
<td>Structural analysis tools</td>
<td>Tools, EspINA</td>
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<td>Functional analysis tools</td>
<td>Tools, Elephant</td>
<td>Functional Data Analysis Tools. Elephant is a package for the analysis of neurophysiology data based on Neo.</td>
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<td>Rat hippocampal region</td>
<td>Tools, Rodent Workbench</td>
<td>Rodent Workbench. The workbench is a mesh-based viewer for Rodent atlases.</td>
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<td></td>
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<td>BigBrain</td>
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<td>User documentation</td>
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Annex 2: Screenshots of Tools & Features Available in this Platform Release

**Figure 1: Screenshot of the Neuroinformatics Platform Homepage**
### Explore the data

Start typing...

**Filters**

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<th>Undefined Pyramidal Cell</th>
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<td><strong>Domain aspects</strong></td>
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<td>tissue slices</td>
</tr>
<tr>
<td>single cell reconstr...</td>
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<td>reconstruction</td>
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<td>manual reconstruction</td>
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<td>biocytin</td>
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<tr>
<th><strong>Methods</strong></th>
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<td>slice staining for mor...</td>
</tr>
<tr>
<td>slice extraction for el...</td>
</tr>
<tr>
<td>morphological recon...</td>
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<td>labeling of cells for mor...</td>
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<table>
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<th><strong>Brain regions</strong></th>
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<tr>
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</table>

<table>
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<tr>
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<tr>
<td>lnmc, epfl</td>
</tr>
<tr>
<td>kisvarday lab, deb</td>
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<td>bbg, epfl</td>
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Figure 2: Screenshot of Brain Atlas Search
**Figure 3: Screenshot of Brain Atlas Tools**

<table>
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<th>Data Provider</th>
<th>Methods</th>
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<tbody>
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<td>HUST – Image Capture</td>
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<tr>
<td>Age: postnatal day 70</td>
<td></td>
<td>Reconstruction of Multiple Cell Morphologies from an Image Stack</td>
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<tr>
<td>Strain: Sprague Dawley</td>
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<td>Extraction of Single Cell Reconstruction from Multi Cell Reconstruction File</td>
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<td>Lab Name: animal</td>
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<td>Slice Joining</td>
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<tr>
<td>Sex: male</td>
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<td>Pyramid Construction (BSIC)</td>
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<tr>
<td></td>
<td></td>
<td>Projection Extraction</td>
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<tr>
<td></td>
<td></td>
<td>Image Reslicing</td>
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Data provided by the Visible Brainwide Networks Project, Britton Chance Center for Biomedical Photonics, Wuhan, China
### active cases

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<th>final n</th>
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<th>when</th>
<th>what</th>
<th>where</th>
<th>how</th>
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<td>✔</td>
<td>✔</td>
<td>nathan</td>
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</table>

*Figure 4: Screenshot of Data Tracker*
Structural data analysis

Much of the structural data produced by modern neuroscience takes the form of image stacks from light and electron microscopy, MRI, PET, etc. As many of these techniques produce terabytes of data in a single session, the best way to unlock the information they contain is through automatic image processing. The HBP will integrate and develop tools for this.

The tools will include software to automate the extraction of cell densities and distributions; the reconstruction of neuron morphologies; the determination of subcellular properties such as synapse and organelle geometry, size and location; and the identification of the long-range fibre tracts underlying connectivity.

The tools contributed by HBP are:

EspINA
Segmentation and annotation of brain tissue microscopy stacks.

EMDigest
Analysis of experimental data obtained by EM and light microscopy.

Figure 5: Screenshot of Structural Analysis Tools
EspINA

What is EspINA?

ESPINA is a tool designed to perform automatic segmentation and 3D volume reconstruction of cerebral cortex structures, helping the user to examine large tissue volumes and interactively validate the results provided by the software.

Functionality

- Navigate hi-resolution stacks of tissue from most common image formats: TIFF, Metaimage
- Reconstruct structures from both optical and electron microscopy images
- Simultaneous visualization of multiple stacks even with different properties
- Real tissue edge detection
- Configure stack properties (such as brightness or contrast)

Links

- Documentation
- Source

Figure 6: Screenshot of Structural Analysis Tools
Functional data analysis

Understanding of brain function depends on data from a wide range of techniques. It is important that simulation results be comparable against this data. To meet this need, the HBP will develop new tools and techniques to compare data from simulations against data from experiments. These will include tools for population analysis (measurement of local field potentials, EEG, fMRI, MEG etc.), and tools for the analysis of single cell activity. Some of these tools will build on previous work in the BrainScaleS project.

The tools contributed by HBP are:

Elephant
Electrophysiology Analysis Toolkit.

Figure 7: Screenshot of Functional Analysis Tools
Elephant - Electrophysiology Analysis Toolkit

What is Elephant?
Elephant (Electrophysiology Analysis Toolkit) is an open-source, community centered library for the analysis of electrophysiological data in the Python programming language. The focus of Elephant is on generic analysis functions for spike train data and time series recordings from electrodes, such as the local field potentials (LFP) or intracellular voltages. In addition to providing a common platform for analysis codes from different laboratories, the Elephant project aims to provide a consistent and homogeneous analysis framework that is built on a modular foundation.

Functionality
- Analysis functions use consistent data formats and conventions as input arguments and outputs. Electrophysiological data will generally be represented by data models defined by the Neoprject.
- Library functions are based on a set of core functions for commonly used operations, such as sliding windows, converting data to alternate representations, or the generation of surrogates for hypothesis testing.
- Accepted analysis functions must be equipped with a range of unit tests to ensure a high standard of code quality.

Links
- Documentation
- Source

Figure 8: Screenshot of Functional Analysis Tools
Figure 9: Screenshot of Waxholm Brain Atlas
Figure 10: Screenshot of Human Brain Atlas
Rodent workbench

What is the Rodent workbench?
The Workbench is a mesh-based viewer for Allen Brain mouse atlas and Waxholm Space atlases for mouse and rat.

Functionality
Web application providing access to vector based versions of mouse and rat brain atlases in standardized 3D space for real-time viewing of shape, size and neighboring relationships of brain structures, and viewing of boundaries of brain structures in any user defined cut plane.

The available mouse and rat brain volumetric atlases are presented through a browser-based viewer for real-time visualisation of mesh data. Since meshes representing adjacent structures typically intersect with each other, visual artefacts occur when rendering them. In order to ensure strict non-intersecting property of meshes, a custom mesh generator tool has been used to create the meshes based on the volumetric parcellations of structures. The tool generates a quad for each face of a voxel-cube which is facing a voxel and is not part of the structure, before applying a CESN-like (Constrained Elastic Surface Net) algorithm for smoothing the mesh. In the final release, it is the aim to support viewing of anchored 2D image data, and viewing of the locations of any data set.

Links
› Workbench

Release
› Internal HBP release March 2015,
› Partial public release June 2013 and
› Full public access December through The Rodent Brain WorkBench.

Figure 11: Screenshot of Rodent Workbench
AligNII

What is the AligNII?
AligNII is an online tool for user guided registration of 2D image data to volumetric atlas templates for the mouse or rat brain.

With use of the tool, data are anchored to Waxholm Space (mouse and rat) or Allen Brain atlas space (mouse), facilitating data integration through standardized coordinate systems.

Functionality
A key feature in the tool is the capability to generate user defined cut planes through the atlas templates, matching the orientation of the cut plane of the 2D experimental image data, as a first step towards anchoring of images to the relevant atlas template.

AligNII supports multi-modality 3D atlas packages and one-click switching between image modalities (e.g., MRI and DTI) while preserving the view location and UI settings in general, and in-depth numerical control over cut plane settings. The tool has been tested extensively and is improved based on user feedback. A series of research projects are currently using the tool for registration of project data to standardized atlas space.

Links
\[ AligNII \]
\[ Tutorial \]

Release
Tool integrated in the Navigator data system
\[ Internal HBP release October 2014 \]
\[ Update February 2015 \]

Figure 12: Screenshot of AligNII: Atlas Registration Tool
Figure 13: Screenshot of AligNII Showing the Results of Data Anchoring
Figure 14: Screenshot of Atlas Viewer in AligNII
Documentation

The generation of data, while challenging in the set up phase, is often nothing compared to trying to ensure the data is accessible to others. While data standards are not new concepts it is often challenging to get support in the the process of adopting data standards. On the documentation pages we are introducing tested approaches to ensure data and analysis results are accessible for other researchers who can then build on top of it, and cite your original findings in the process. If we can help you in any way to make you data more accessible don’t hesitate to contact us.

This serves as the common data store and provenance tracker for all types of data, models, and literature produced and consumed by other services, tools and platforms in HBP.

Data shared on the Neuroinformatic platform (NIP) are enriched with minimal metadata, HBP-CORE, to provide essential information in order to ensure traceability of any data artefact. Moreover, it is of utmost importance that datasets are collected and processed in compliance with EU ethical standards.

Data standards

› Electrophysiology standards
› Neuroimaging standards
› Proteomic standards
› Neuron reconstruction standards
› Transcriptomic standards

Tidying data

Guidelines for data providers to create accessible datasets for further usage and analysis.

Figure 15: Screenshot of Documentation