Project Number:	604102	Project Title:	Human Brain Project

Document Title:	Neuroinformatics Platform v1 — Documentation
Document Filename:	SP5 D5.8.5 resubmitted FINAL.docx
Deliverable Number:	D5.8.5
Deliverable Type:	Prototype
Work Package(s):	WP5.1, WP5.2, WP5.3, WP5.4, WP5.5, WP5.6, WP5.7, WP5.8
Dissemination Level:	PU = Public
Planned Delivery Date:	RUP M30 / 31 Mar 2016
Actual Delivery Date:	RUP M30 / 31 Mar 2016, resubmitted SGA1 M6 / 23 Sep 2016

Authors:	Sean HILL, EPFL (P1); Sten GRILLNER, KI (P31)
Compiling Editors:	Sean HILL, EPFL (P1); Sten GRILLNER, KI (P31)
Contributors:	EPFL (P1): CNRS (P7): Andrew DAVISON JÜLICH (P17): Michael DENKER, Sonja GRÜN, Alper YEGENOGLU SKU (P49): Paul TIESINGA UPM (P59): José Maria PEÑA, Pedro LARRAÑAGA (P68): Jan BJAALIE ; Pascal FUA (EPFL (P1).
Coordinator Review:	EPFL (P1): Jeff MULLER, Martin TELEFONT UHEI (P45): Sabine SCHNEIDER, Martina SCHMALHOLZ
Editorial Review:	EPFL (P1): Guy WILLIS, Lauren ORWIN, Colin McKINNON

Abstract:	The Neuroinformatics Platform and the Brain Atlases will allow neuroscientists to collaboratively curate, analyse, share, and publish large-scale neuroscience data. The goals of Neuroinformatics Platform is to provide to the neuroscientist community with: - An integrated multi-level, data enriched atlas of the rodent brain. - An integrated multi-level, data enriched atlas of the human brain. - Tools to curate and spatially register datasets to standard reference atlases. - Identify or develop ontologies to qualify and describe data, enabling data navigation and search. - Analytics pipeline to automatically process sub-sets of data in order to provide and integrated view of the multi-level atlases to users. - 2D and 3D Viewers to navigate, query and annotate the atlases. - Programmatic API to access data in the atlases.
Keywords:	Neuroinformatic, Brain, Atlas, collaborative, curate, spatial registration, federate data mining, data repository, ontology, standards

Table of Contents

List of Tables

1. The Aim of this Document

The aim of this document is to detail the technical and user documentation available to internal and external users of the Neuroinformatics Platform (NIP), and to provide a roadmap describing plans for future Platform development.

The NIP website documentation includes a User Manual, a Data Integration Manual and Technical Manual, which explain in detail the architecture, components and tools developed for the Platform. The above manuals form three separate Appendices to this document:

- **SP5 D5.8.5 Appendix 1 NIP User Manual 2016.pdf** (for end users of the Platform)
- **SP5 D5.8.5 Appendix 2 NIP Data Integration Manual 2016.pdf** (for data curators & integrators)
- **SP5 D5.8.5 Appendix 3 NIP Technical Manual 2016.pdf** (a technical guide for developers)

This documentation can also be found online :

https://nip.humanbrainproject.eu/documentation/

as well as through the HBP Collaboratory following :

https://collab.humanbrainproject.eu/#/collab/47/nav/5245

The roadmap of the Future Platform development is an ongoing process and will be released by the HBP's Data Planning and Information Team (DPIT) as an SGA1 Month 6 Deliverable, which will include a Revised SP05 workplan for SGA1.

2. Technical and User Documentation

2.1 Technical Documentation

Documentation on all NIP tools and components can be accessed via the HBP Collaboratory. Each tool is provided with its own specific documentation, as follows:

Neuroinformatic platform: https://collab.humanbrainproject.eu/#/collab/47/nav/5245

Search API: https://collab.humanbrainproject.eu/#/collab/47/nav/5234

Voxel Atlas API: https://collab.humanbrainproject.eu/#/collab/47/nav/5242

Ontology Service API: https://collab.humanbrainproject.eu/#/collab/47/nav/7267

3DSomaMS: http://vps136.cesvima.upm.es/Docs/somaMS/

3DSynapsesSA: http://vps136.cesvima.upm.es/R/

Elephant: http://elephant.readthedocs.org/en/latest/developers_guide.html

EspINA: https://launchpad.net/~cbbp/+archive/ubuntu/main

Morphology Viewer: https://github.com/rbakker/HBP-morphology-viewer

AligNII: http://www.nesys.uio.no/AligNII

QuickNII: http://www.nesys.uio.no/AligNII

MeshGen: http://software.incf.org/software/meshgen

MeshView: http://software.incf.org/software/meshgen

CutNII: http://software.incf.org/software/cutnii

Scalable Brain Atlas: http://scalablebrainatlas.incf.org/main/index.php?

SynapseGenerator:
https://collab.humanbrainproject.eu/#/collab/47/nav/2784?state=uuid%3D79042414-6074-4daf-a4c0-6b9ead269cfe

Knowledge Space: https://github.com/OpenKnowledgeSpace/KnowledgeSpace

2.2 User Guidebook

The Neuroinformatics Platform User Guidebook gives detailed guidance on how to use the Platform. Each tool is provided with its own specific documentation, as follows:

Neuroinformatic platform: https://collab.humanbrainproject.eu/#/collab/47/nav/5245

3DSomaMS: http://vps136.cesvima.upm.es/Docs/somaMS/

3DSynapsesSA: http://vps136.cesvima.upm.es/Docs/synapsesSA/

Elephant: http://elephant.readthedocs.org/en/0.2.0/

EspINA: https://www.youtube.com/channel/UCN3kLTMxaJXkEJrvsJbx-ww

Morphology Viewer: https://neuroinformatics.nl/HBP/morphology-viewer/

AligNII: http://www.nesys.uio.no/wiki/xnii_application_family.html

QuickNII: http://www.nesys.uio.no/wiki/xnii_application_family.html

MeshGen: http://software.incf.org/software/meshgen

MeshView. http://software.incf.org/software/meshgen

CutNII: http://software.incf.org/software/cutnii

Scalable Brain Atlas : http://scalablebrainatlas.incf.org/main/index.php?

SynapseGenerator : http://www.neuroinformatics.nl/SynapseGenerator/index.html

Knowledge Space: https://www.knowledge-space.org/NeuroKS/index.php/Documentation

3. Future Development of the Platform

The roadmap for future development of the NIP Platform is an ongoing process and will be released by the HBP's Data Planning and Information Team (DPIT) as an SGA1 Month 6 Deliverable, which will include a Revised SP05 workplan for SGA1.

Annex A: Glossary

Table 1: Glossary

2D image	High-resolution bitmap image, currently supported formats: TIFF, JPEG, PNG; work in progress: Yokogawa CV1000, CZI. The list of the supported formats relies on OME Bio-Formats library.
3D data	Coming from a soma confocal microscopy image contains 3D points and the edges that join them (the faces). This data contains the 3D representation of the soma that is computed and statistically analysed to obtain the quantitative characterisation.
3D stack	A series of 2D consecutive images from a tissue sample or preparation obtained vie electron or light microscopy.
3D template package	A general 3D template package consists of an MRI template (NIfTI file), a delineations template (NIfTI file, produced from MRI template) and meshes (STL files, produced from delineations template).
AligNII	Browser-based anchoring tool.
Anchoring	The process of positioning (translate, rotate, scale) 2D images in 3D space defined by a 3D template package. Through region-by-region anchoring, several positions could be stored for each 2D image.
Annotations	Vector drawings (SVG) superimposed on 2D images.
Brain addressing system	Builds connectivity matrices. Neurons in the source area send out axons that terminate on the dendrites and soma of neurons in the target area. Each neuron has dendrites and an axon, both of which can be described in terms of a branching structure. An instantiated synaptic connection is characterised by the index of the sending neuron, the index of receiving neuron, the index of axonal branch of the sending neuron and index of the dendritic branch of the receiving neuron between which the synapse is made.
Brain atlas	A collection (usually a stack) of 2D images anchored to a 3D template package.
Complete spatial randomness (CSR)	AKA homogeneous Poisson process. ‘Reference’ or ‘benchmark’ model of a random point pattern.
Converter	A server-side process of creating pyramids, previews and thumbnails from 2D images.
Data file	A file that contains data common to electrophysiological recordings. This includes in particular, but is not limited to, spike time data, discretely sampled continuous signal data (such as LFP or measures of the stimulus), and trigger events. In the context of the Unified Portal, data files represent an artefact.
Delineations	Boundaries of structures in the brain shown in the context of brain atlas space.
Dendritic basal arbour	The part of the neuron that includes the general features of the neuron observed from the apical dendrite, such as the layout of the basal dendritic trees and their features.

Dendritic & soma data	Contains properties of dendritic specification and quantitative characterisation of the soma.
F function	Cumulative distribution function of the empty space distance.
G function	Cumulative distribution function of the nearest-neighbour distance for a typical point in the pattern.
HDF5	A hierarchical file format designed to store numerical data.
Hybrid Bayesian network	A Bayesian network that combines continuous, discrete and in this case, also angular variables.
K function	Ripley's function, expected number of other points of the process within a distance r of a typical point of the process divided by the intensity.
L function	Commonly used transformation of K function making visual assessment of the graph much easier.
Local field potential (LFP)	The continuous low-pass filtered signal from an extracellular recording electrode (high cut of the filter typically in the range of 100-500 Hz).
Metadata	The data available and recorded, either in an automated fashion or by the user, before, during and after an experiment providing additional information relevant in interpreting and relating the electrophysiological and behavioural recordings.
Optimisation data	Contains the data corresponding to a 3D soma shape generated by simulation.
PAB	Metadata in the hierarchical form: Project -> Animal(s) -> Block(s).
Pathway data object	Contains an instantiation of a connection matrix.
Pathway validation data object	Contains the validation data of a pathway data object
Preview	A downscaled copy of 2D image.
Projection data object	Contains the statistics of the projection between two areas and can be accessed in the atlas by referring to the sending as well as receiving area.
Random sequential adsorption (RSA)	Spatial process where the pattern is constructed by placing spheres in three-dimensional space iteratively and randomly, with their radii following a probability density function. If any newly generated sphere intersects with an existing sphere, the new sphere is rejected and another sphere with a different centre and radius is generated. This process is stopped when the required number of spheres is reached.
Sample	The original tissue preparation from which a 3D stack is obtained.
Segmentation	A set of different segmented structures.
Segmented structure	A set of 3D voxels corresponding to a biological structure (either cell or sub-cell entities) annotated with its corresponding semantic information.
Soma	Represented by several morphological characteristics. Somas are described by a set of statistical distributions which represent their main properties as

	height, width, volume, etc.
Spatial point pattern	Realisation of a spatial point process.
Spatial point process	Mathematical model that describes the arrangement of objects irregularly or randomly distributed in space forming patterns.
Spike	The action potential of a neuron and its time point of the firing. Spikes are measured by an extracellular recording electrode in the vicinity of a neuron. Spikes are detected as a threshold crossing-event on the electrode signal that displays a typical spike waveform (to distinguish it from recording artefacts).
Spike sorting	The process of assigning labels to the individual spikes in an electrophysiological recording in order to group those spikes, which are likely to have originated from a single neuron. Labels are assigned on the basis of the similarity of observed spike waveforms in the analogue signal.
Stereological counting frame/counting frame	Inclusive/exclusive boundaries of the 3D stack to be considered in the counting of segmented structures.
Synaptic apposition surface (SAS)	The surface between the active zone and the post-synaptic density representing the area of the synaptic junction.
Template	Data set specifying a brain atlas space, i.e., a 3-D coordinate system of the brain.