Providing community access to large-scale neuromorphic computing systems

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The EBRAINS Neuromorphic Computing Platform

EBRAINS Research Infrastructure offers access to two unique large-scale neuromorphic computing systems :

BrainScaleS : the physical model machine
Location : Heidelberg (Germany)

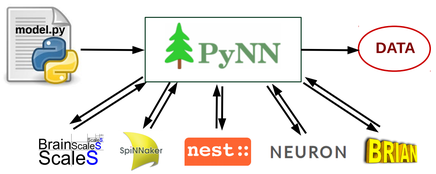
- 20 wafer modules
- Local analogue computing
- 4 million neurons
- 1 billion plastic synapses
- Binary, asynchronous communication
- running at x10000 real-time

SpiNNaker : the many-core machine
Location : Manchester (UK)

- over 1 million cores
- up to 1 billion neurons
- up to 1 trillion synapses
- address-based, small packet, asynchronous communication
- real-time simulation

PyNN : a common API for neuronal network modelling

- ▷ facilitate model sharing and reuse
- ▷ simplify validation of simulation results
- ▷ provide a common platform on which to build other tools
- ▷ provide a more powerful API for neuronal network modelling
- ▷ hide complexity of parallelization from user




```
import pyNN.nest as simulator
import pyNN.neuron as simulator
import pyNN.brian as simulator
import pyNN.brainscales as simulator
import pyNN.spiNNaker as simulator

cell_type = ...

p1 = simulator.Population(size1, cell_type, structure)
p2 = simulator.Population(size2, another_cell_type, structure)

all = p1 + p2
all.record(["spikes", "v"])

connections = simulator.Projection(p1, p2, connection_rule, synapse_type)

simulator.run(1000.)
```

PyNN is a **simulator-independent language** for building spiking neuronal network models and provides a library of :

- ▷ standard neuron, synapse and synaptic plasticity models
- ▷ commonly-used connectivity algorithms

The user is not restricted to the standard models and can also use any neuron or synapse model supported by your simulator.

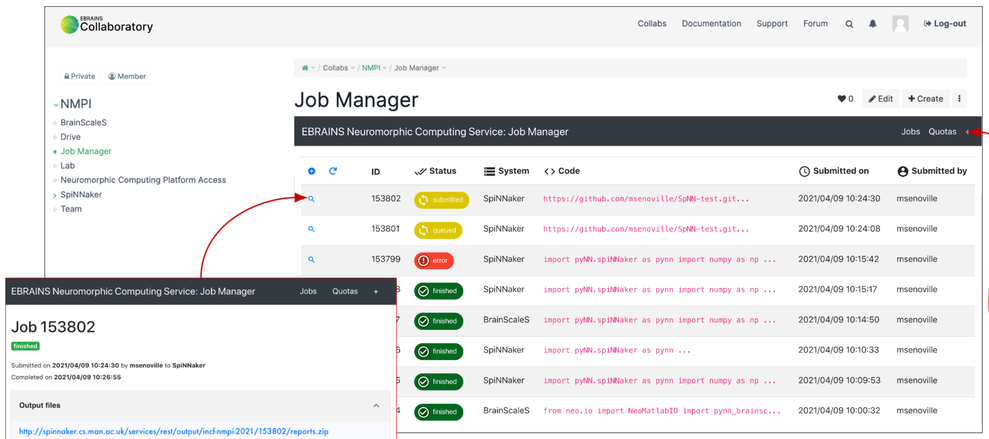
For downloads and full documentation see :
http://neuralensemble.org/PyNN/

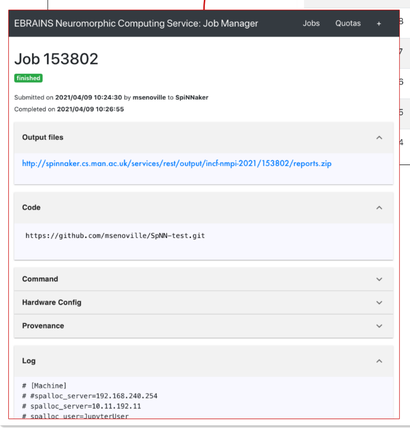
Request free test access

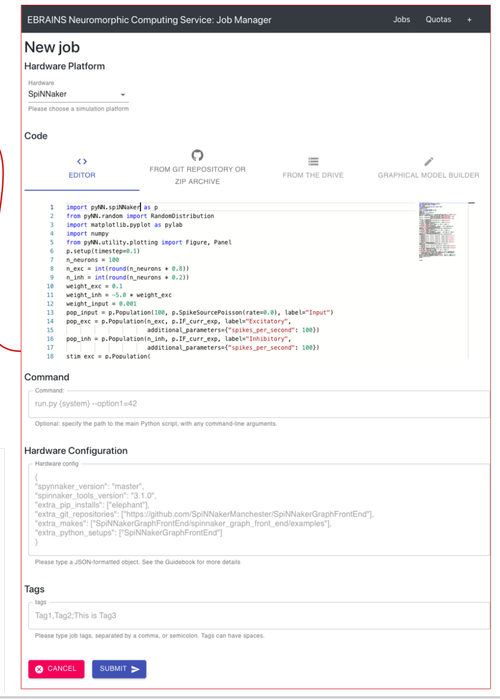
▷ To receive support and advice, visit
https://ebrains.eu/support/

https://ebrains.eu/service/neuromorphic-computing/

Access through the Collaboratory



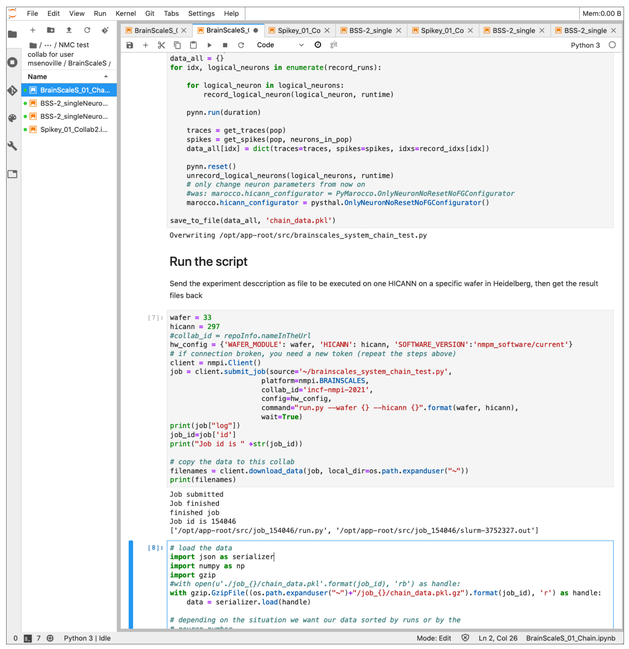




The Neuromorphic Job Manager is a web based app providing a graphical interface for submitting jobs to the BrainScaleS and SpiNNaker systems and for retrieving job results, with detailed provenance metadata including full log files.

As a Community app the Job Manager is integrated into the EBRAINS Collaboratory, which aims to be a workspace for scientific collaboration, sharing and collaboration around data, software and services.

Access through Jupyter Notebooks



Batch mode via a Jupyter Notebook

- ▷ in the EBRAINS Collab ("Lab")
- ▷ on local computer

Requires the use of a **Python Client** : the model is sent as file to the neuromorphic systems, then executed and the results are sent back as files.

Installing the Python client

```
$ pip install hbp_neuromorphic_platform
```

Using the Python client

```
In [1]: import nmpi
In [2]: c = nmpi.Client("myusername")
In [3]: job_id = c.submit_job(source="/path/to/my/code/PyNN_script.py",
                              platform=nmpi.BRAINSCALES,
                              collab_id="collab-name")
Out[3]: Job submitted

In [4]: c.job_status(job_id)
Out[4]: 'queued'

In [5]: job = c.get_job(job_id, with_log=True)

In [6]: c.download_data(job, local_dir="/path/for/download")
Out[6]: ['/path/for/download/job_123/sim_results.png','/path/for/download/job_123/reports.zip']
```

An interactive mode is also available on :

- ▷ BrainScaleS : https://juphub.bioai.eu/
- ▷ SpiNNaker : https://spinn-20.cs.man.ac.uk/

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