The EBRAINS Interactive Workflows for Cellular Level Modeling (CLSI)

Luca Leonardo Bologna (CNR)

lucaleonardo.bologna@cnr.it

EBRAINS Tools for Teaching: Leveraging EBRAINS Open Science Tools for Neuroscience Education
EBRAINS Tutorials and Users Day, 12 March 2025 | Heidelberg, Germany

Co-funded by
the European Union

The EBRAINS CLSI for Teaching

https://www.ebrains.eu/

https://ebrains-cls-interactive.github.io/index.html

Ecosystem of Workflows and Use Cases for cellular level simulation and analysis

The EBRAINS CLSI for Teaching

Build, reconstruct, and simulate data-driven brain models

- Build single cell and small circuits

- Perform data analysis on recorded and simulated neural activity

- Run the models on EBRAINS HPC resources

- Share your results and code with the scientific community via the EBRAINS platforms
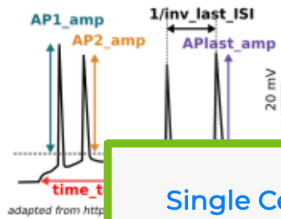
Prerequisites for students

- EBRAINS account (register at https://www.ebrains.eu/page/sign-up)

No programming skill is required

- Familiarity with Python Jupyter Notebooks might be helpful if you want to modify the tools yourself and for your own needs
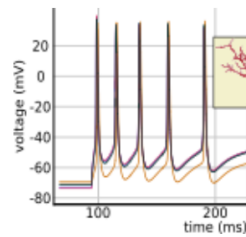
EBRAINS

EBRAINS CLSI: multiple tools for multiple scales

Trace Analysis

NeuroFeatureExtract

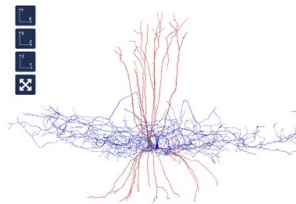**Extracts electrophysiological features; trace** [can] **be from HBP/EBRAINS or uploaded**

Single Cell In Silico Experiment

Single cell in silico experiments under current clamp

Rattus norvegicus > Hippocampus CA1 > interneuron >
CA1_int_cNAC_990111HP2_20190329155703

Rattus norvegicus > Hippocampus CA1 > interneuron >

Single Cell Modeling

Hodgkin-Huxley Neuron Bui[lder]

Use the eFEL and BluePyOpt libraries to go [...]

Small Circuit In Silico Experiment
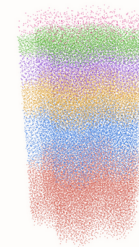
Mouse O1 - Scaffold Somatosensory Cortex Microcircuit for Mouse

This model combines specific datasets obtained for mouse somatosensory cortex, models of neuronal electrophysiology constrained to mouse primary visual cortex data from the Allen Cell Types Database, and datasets that were algorithmically transformed from rat to mouse.

Credits: Michael W. Reimann (michael.reimann@epfl.ch)Eilif Muller (eilif.mueller@epfl.ch)Srikanth Ramaswamy (srikanth.ramaswamy@epfl.ch)
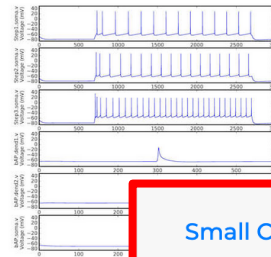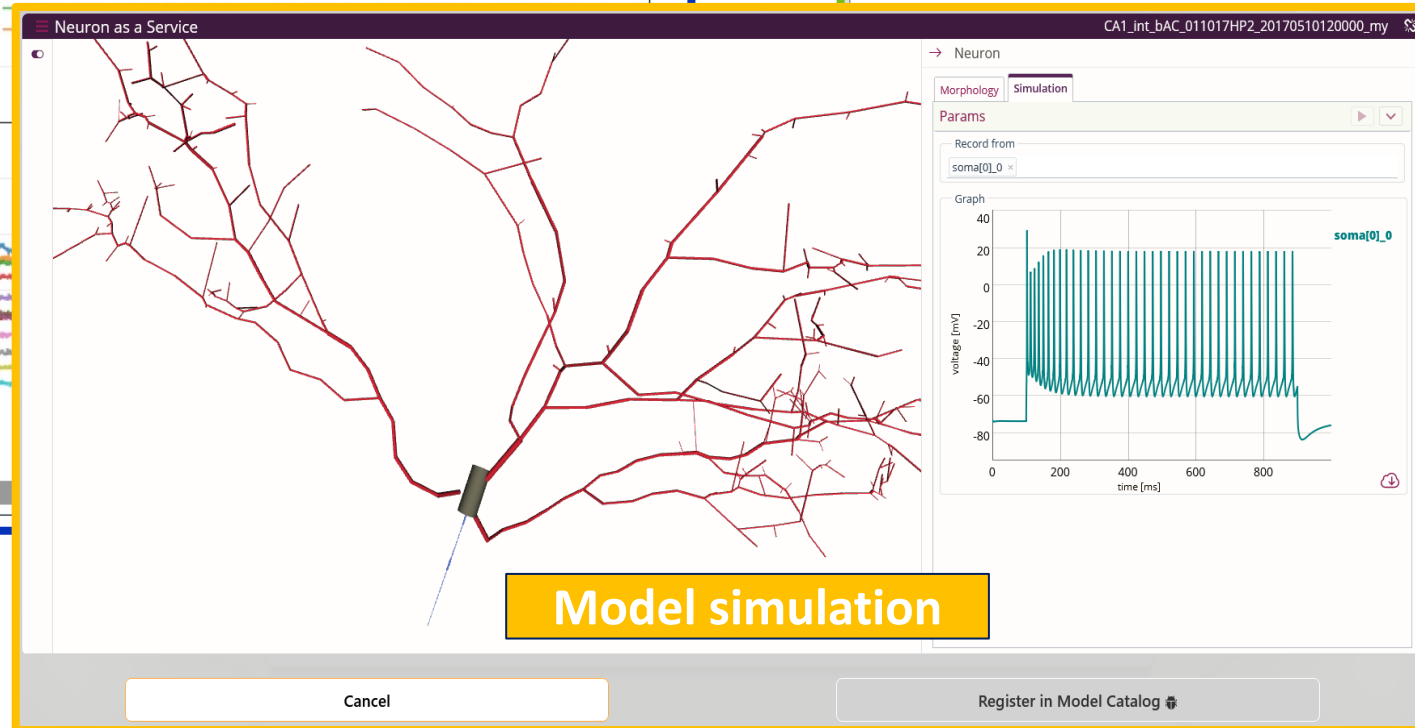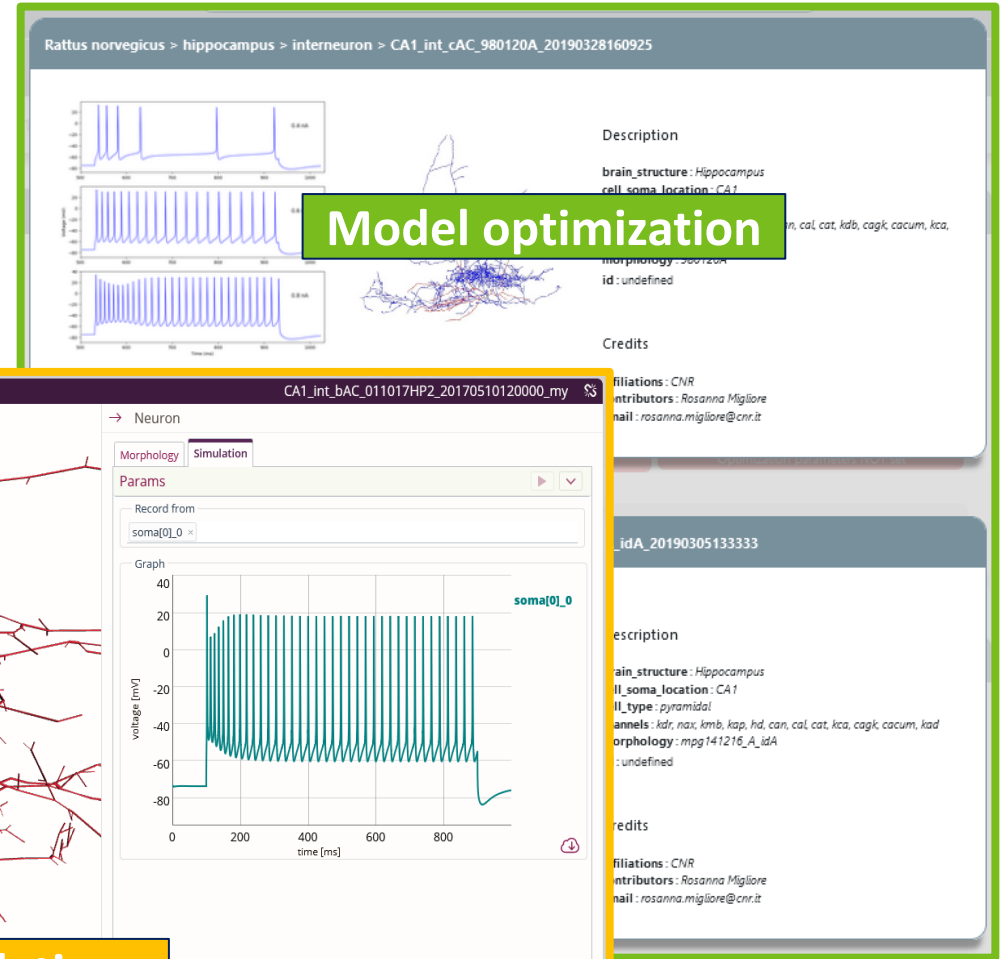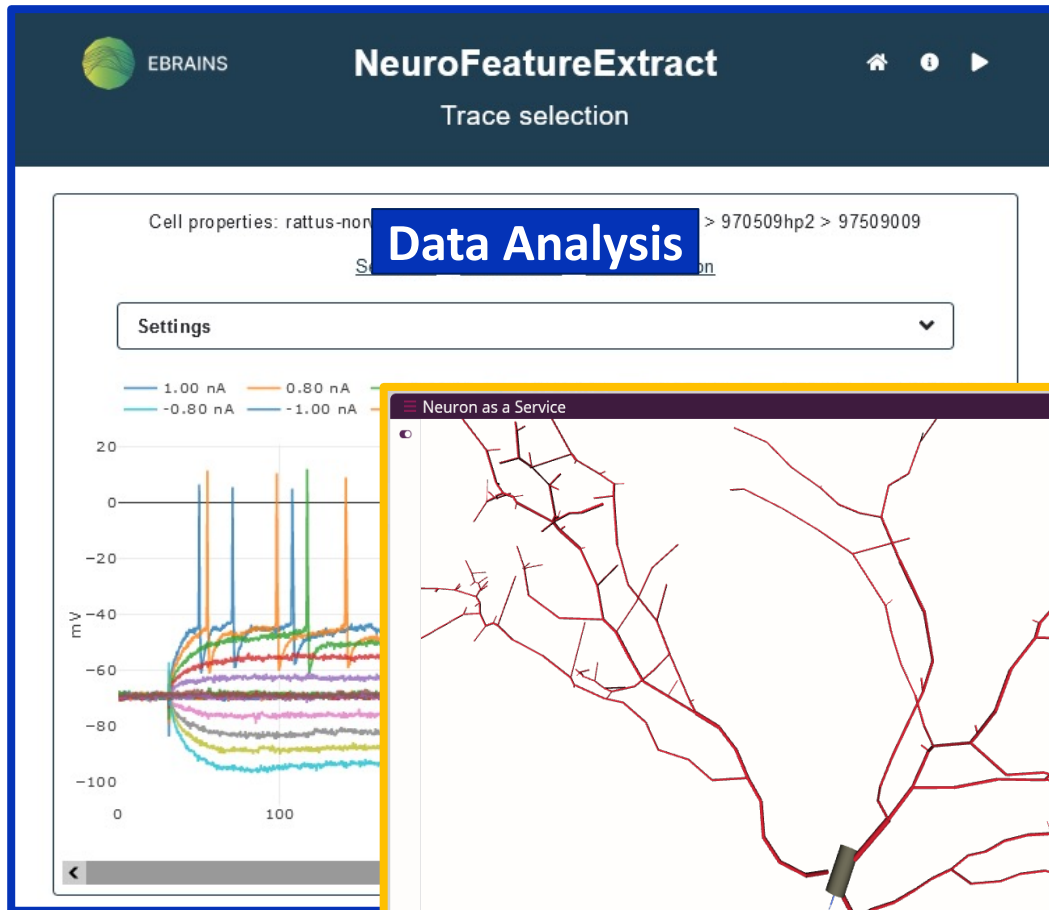
Morphology

Morphology visualization

Display neuron morphology in 3D

CA1_int_cNAC_990611HP2_2019032816[...]

Rattus norvegicus > Hippocampus CA1
CA1_int_cNAC_990111HP2_2019032915[...]

Rattus norvegicus > Hippocampus CA1
CA1_int_cNAC_980513B_201903291555[...]

Rattus norvegicus > Hippocampus CA1

Credits: Genrich Ivaska

EBRAINS CLSI: multiple tools for multiple scales

EBRAINS CLSI: use EBRAINS HPC resources via the service account
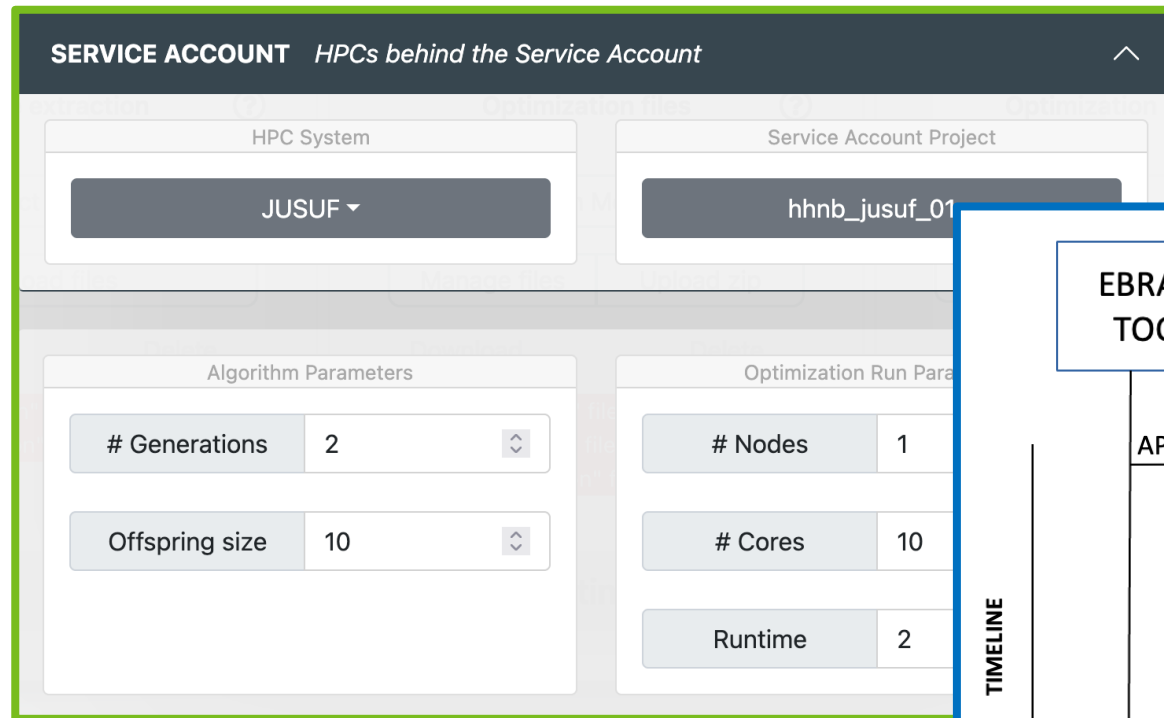
No need for HPC credentials ...

... just SIGN UP on ebrains.eu

EBRAINS tools in a classroom context

- Success factors and challenges regarding the use of open science tools in a classroom setting:
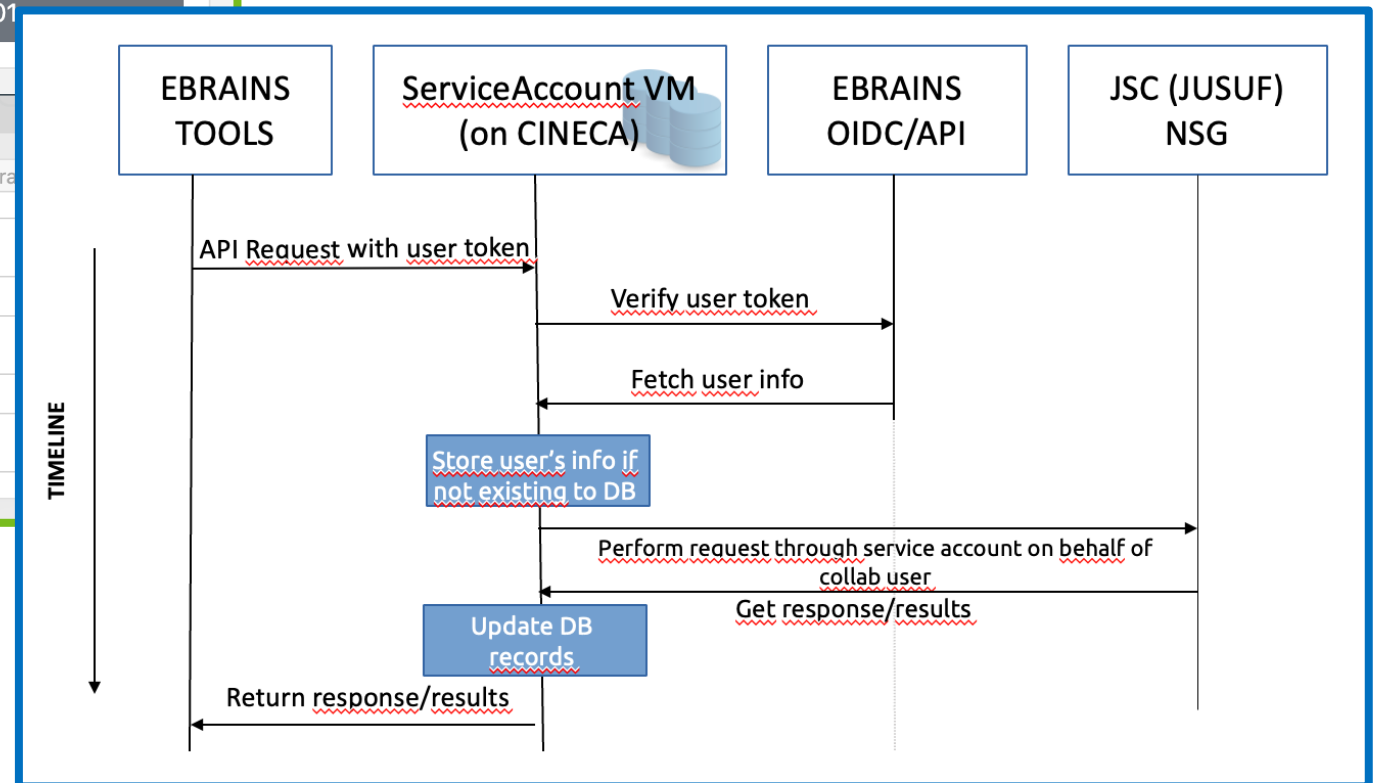
  - Shared results and methodology

  - Concurrent access and brainstorming

  - Time constraint -> work together, work alone, share results

- Future goals for the tools in the context of its use for teaching

  - Fetch increasingly more resources from public online platforms

  - Foster students' contribution to the tools and to the scientific community

EBRAINS

EBRAINS tools in a classroom context

Yearly: EBRAINS Brain Simulation School (2025 https://conf.snn.ro/ebrains/)

Finanziato dall'Unione europea NextGenerationEU | Ministero dell'Università e della Ricerca | Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA | Consiglio Nazionale delle Ricerche

Progetto EBRAINS-Italy - Missione 4, Componente 2, Linea di investimento 3.1 del PNRR
Finanziato dall'Unione europea – NextGeneration EU (CUP B51E22000150006)

EBRAINS-Italy Brain Simulation Training Workshop
Brasov (Romania), 27-29 May 2025

The school will introduce the students to the EBRAINS-Italy Research Infrastructure workflows for Computational Neuroscience, with the main aim to extend access to this field and related tools to the average user from a variety of scientific communities. After the course, students will have a deeper understanding on the techniques and the scientific issues underlying the implementation of multiscale computational models or neurons and networks; students will also be able to use the Platform and access supercomputer systems to configure and run simulations and visualize/analyze the results.

EBRAINS

Thank you

Co-funded by
the European Union