In Silico neuroscience

Summary

“In silico Neuroscience” introduces students to a synthesis of modern neuroscience and state-of-the-art data management and computing technologies. This includes perspectives on neuroinformatics, neurosimulation, scientific computing, neuromorphic computing, clinical informatics, ethics and policy.

Content

“In silico Neuroscience” introduces masters students to a synthesis of modern neuroscience and state-of-the-art data management and computing technologies. The course will cover a number of key topics including: 1) how neuroscience data is acquired, organized and integrated (neuroinformatics), 2) data-driven modeling and validation of synapses, cells and networks (neurosimulation), 3) software technologies for simulation and analysis (scientific computing), 4) how the brain as a computational device may influence information technology (neuromorphic computing), 5) how to generate “big data” from the clinic (clinical neuroinformatics), 6) Ethical issues, and the global outlook including the emerging large-scale brain initiatives. The target audience are technically adept students in the EPFL Neuroscience program and students from other programs (e.g. I&C, SB, CSE) interested in applying their domain techniques to neuroscience.

Learning Prerequisites

Recommended courses
- Neuroscience II
- Introduction to programming
- Projects in informatics

Important concepts to start the course
- general knowledge on cellular neuroscience
- experience in elementary programming (preferentially python)

Learning Outcomes

By the end of the course, the student must be able to:

- Choose appropriate annotations and provenance standards for experimental data
- Interpret discrepancies between experimental findings
- Assess / Evaluate different level of detail formulations of models
- Integrate biological facts into detailed neuron and tissue models
- Apply model concepts in simulations
- Exploit standard modelling and simulation software
- Analyze model predictions
- Explain formalisms and approaches in simulation software
Teaching methods
Classroom teaching & exercises
group work

Assessment methods
Written exam (100%)