BIOENG-450

In silico neuroscience

Hill Sean, Schürmann Felix

Cursus	Sem.	Type
Computational Neurosciences minor	E	Opt.
Neuroprosthetics minor	E	Opt.
Neuroscience		Opt.
Sciences du vivant	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

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%)