NX-450

Computational neurosciences: biophysics

Romani Armando

Cursus	Sem.	Type
Computational Neurosciences minor	H	Opt.
Life Sciences Engineering	MA1, MA3	Opt.
Neuro-X minor	H	Opt.
Neuro-X	MA1, MA3	Opt.
Neuroprosthetics minor	H	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course introduces students to a synthesis of modern neuroscience and state-of-the-art data management, modelling and computing technologies with a focus on the biophysical level.

Content

The course introduces masters students to a synthesis of modern neuroscience and state-of-the-art data management, modelling and computing technologies. Following fundamental structural and functional building blocks of the mammalian brain from cells to circuits, the course teaches applied biophysical modeling for each of these building blocks and showcases applications thereof in modern neuroscience. Accordingly, the course covers a number of key technologies, including 1) how neuroscience data is acquired, organized and integrated, 2) data-driven modeling and validation, 3) simulation and analysis technologies.

Keywords

data management, biophysically detailed modeling, scientific computing, simulation

Learning Prerequisites

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:

- 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

The course will take place in presence on the EPFL campus.
Structure: each week there will be

- 2x45min lecture
- 45min interactive discussion with the teachers & TAs
- 45min introduction of homework exercises, Q&A, group work (TAs present)

Exercises

- practical programming/problem solving on topics from the lectures
- done in groups, which remain for the entire semester
- are graded on a weekly basis

Expected student activities

- Students attend lectures
- Students actively participate in the discussion on the topics of the lecture in the discussion session
- Students complete weekly practical programming assignments relevant to the week's lecture in groups
- Students write final exam in exam period

Assessment methods

- Written exam: 70%
- Continuous control (homework): 30%

Resources

Moodle Link

- https://go.epfl.ch/NX-450