neu240 - Computational Neuroscience - Introduction

Module label
Computational Neuroscience - Introduction

Module code
neu240

Credit points
9.0 KP

Workload
270 h

Used in course of study
- Master's Programme Neuroscience > Background Modules

Contact person

Module responsibility
- Jutta Kretzberg

Authorized examiners
- Alle hier genannten

Module counseling
- Martin Greschner
- Jannis Hildebrandt

Entry requirements
attendance in pre-meeting

Skills to be acquired in this module

Upon successful completion of this course, students
are able to implement and apply algorithms
have learned to handle scientific data independently
have acquired theoretical and practical knowledge of advanced data analysis techniques
know about computational model approaches on different levels of abstraction
know how to perform model simulations for single cells and small neuronal networks
can interpret simulation results in a neuroscientific context

Module contents
This course consists of four weeks with different topics, which are introduced in lectures, discussed in depth using selected literature in the seminar and consolidated in computer-based hands-on exercises (in Matlab). Portfolio tasks, mainly interpretation of programming results are given every day.

Week 1: Background and Matlab preparation week
- practice of programming principles (functions, scripts, if, loops, structures, cell arrays)
- revision of neuroscience backgrounds (neuron, membrane, spike)

Week 2: Spike train analysis
- response tuning, spike triggered average, receptive fields, linear-nonlinear model, spike correlation, linear reconstruction, classification

Week 3: Neuron models
- Conductance-based single cell models using differential equations (passive membrane equation, integrate and fire, Hodgkin Huxley, alpha synapses)

Week 4: Network models
- small networks (lateral inhibition, central pattern generator)
- larger networks (Integrate and fire networks, rate models, inhibition-excitation balance, learning)

Reader's advisory
Dayan / Abbott: Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. MIT Press (More text books will be suggested prior to the course).

Scripts for each course day will be provided prior to / during the course
Copies of scientific articles for the seminar will be provided prior to the course

Links
Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Reference text
Course in the first half of the semester

Modullevel
MM (Mastermodul)

Modulart
Wahlpflicht

Vorkenntnisse / Previous knowledge

Examination
Final exam of module
Time of examination
during the course
Type of examination
Portfolio, consisting of daily short tests, programming exercises and short reports

Course type
Lecture
Exercises
Seminar
Comment

SWS

1.00
4.00
1.00
Frequency
14 h
56 h
14 h

Workload attendance

1 / 2
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<td>Total time of attendance for the module</td>
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