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:
Neurosci. knowlg. Expt. methods Independent research + Scient. literature + Social skills
Interdiscipl. knowlg. ++ Maths/Stats/Progr. + Data present./disc. + Scientific English Ethics
Upon successful completion of this course, students
have acquired good programming skills (in Matlab)
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 neuroscience 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

Lern-/Lehrform / Type of program:
Vorkenntnisse / Previous knowledge:

Examination:
Final exam of module: during the course

Time of examination:
Type of examination:
Portfolio, consisting of daily short tests,
programming exercises and short reports

Course type:
Lecture: 1.00
Exercises: 4.00
Seminar: 1.00

Comment:
SWS
Frequency
Workload attendance
14 h
56 h
14 h
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<th>Course type</th>
<th>Comment</th>
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