neu710 - Neuroscientific Data Analysis in Matlab

Module label: Neuroscientific Data Analysis in Matlab
Module code: neu710
Credit points: 6.0 KP
Workload: 180 h

(1 SWS Lecture (VO) Total workload 45h: 10h contact / 20h background reading / 15h exam preparation
1 SWS Seminar (SE) Total workload 45h: 10h contact / 20h background reading / 15h preparation of presentation
2 SWS Supervised exercise (UE) Total workload 90h: 20h contact / 70h home work)

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

Contact person:
Module responsibility
- Jannis Hildebrandt

Authorized examiners
- Jannis Hildebrandt

Entry requirements:

Skills to be acquired in this module:
+ Neurosci. knowlg.
+ Social skills
+ Interdiscipl. knowlg.
++ Maths/Stats/Progr.
+ Scientific English

Upon successful completion of this course, students:
* understand basic programming concepts.
* have good knowledge about the most important aspects of the programming language Matlab.
* are able to use the programming environment for Matlab.
* are able to write their own programs in Matlab.
* know how to use Matlab to specifically analyze neuroscientific data, including:
  > electrophysiological data (continuous and spike trains)
  > basic image processing
  > basic statistical testing.

Module contents:
Lecture topics:
- Basic programming concepts: data types, variables, loops, scripts, functions, linear and object-oriented programming
- Good practice: documenting your own code, back-up and version control.
- Introduction to the programming environment Matlab including the documentation.
- Introduction to the programming language Matlab
- Efficient programming: memory use
- Working with continuous data: basic time series analysis (i.e. LFP and EEG data)
- Fourier transformation
- Short introduction of spike-extraction and spike-sorting
- Representation and processing of spike train data
- Basic image and image series processing for imaging data (i.e. Ca+ imaging, fMRI)
- Statistical testing with Matlab
- Plotting and visualization.

During the seminar, we will discuss strategies for analysis and coding for specific relevant examples of neuroscientific data. The examples are prepared and presented by the students. Students will also present some of the work they did during the exercises. If students bring their own data or plan experiments for a research modul or their thesis project, there will be the opportunity to discuss both analysis strategies and possible implementation in Matlab. Exercise:
- Students will get coding exercises, where they will use the knowledge gained from the lecture. The exercises are a mix of short exercises and longer projects. Projects will be done in small groups (2-3 students).
- The students are encouraged to bring examples of data from experiments they have been involved in or are planning to do.

Reader's advisory:
Pascal Wallisch: MATLAB for Neuroscientists, Elsevier, Oxford

Links:
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: annually, summer term
Module capacity: 24
Reference text:
- shared course components with (cannot be credited twice): pb150 Einführung in die Datenanalyse mit MATLAB
- ---

Modulelevel: ---
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-Lehrform / Type of program: basic knowledge of math and statistics
Vorkenntnisse / Previous knowledge: ---

Examination:
- Time of examination: during the course
- Type of examination: practical exercise - hand in code each week in addition, mandatory but ungraded: presentation during the seminar
<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1.00</td>
<td></td>
<td>14 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td></td>
<td>28 h</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>1.00</td>
<td></td>
<td>14 h</td>
</tr>
</tbody>
</table>

**Total time of attendance for the module**

56 h