Modul 02-BIO-MA-MN-RAND: Recording and Analysis of Neural Data
Recording and Analysis of Neural Data

Modulgruppenzuordnung:

Empfohlene inhaltliche Voraussetzungen:
Lectures and seminars from 1st semester are highly recommended.

Lerninhalte:
This course provides hands-on training in the analysis of large-scale, multimodal neural datasets from systems neuroscience. Students will work with public datasets from the Allen Institute for Brain Science (Visual Coding Neuropixels & 2-Photon imaging), which includes high-resolution Neuropixels recordings, 2-photon calcium imaging data, behavioral data, and pupil diameter measurement as a proxy for neuromodulatory state. The course covers the following core topics:

- **Accessing public neuroscience datasets:** introduction to the Allen Institute's data infrastructure, including web-based interfaces and APIs for data retrieval and organization.
- **Data exploration and preprocessing:** Identification and selection of relevant brain regions, time-window, and stimuli
- **Multimodal data analysis:** Investigating relationships between neural activity and behavior, as well as between neural dynamics and physiological markers.
- **Temporal and spectral analysis:** Application of methods for spike-trains, LFPs, and Calcium signals.
- **Hypothesis-driven research:** Formulation of scientific questions based on the data, design, and execution of analyses, and interpretation of results in a biological context
- **Documentation and scientific communication:** development of a scientific presentation that clearly communicates methods, findings, and interpretations.

Lernergebnisse / Kompetenzen:
Students can

- understand the structure and organization of neuroscience datasets
- apply fundamental exploratory and hypothesis-driven data analysis
- investigate the relationship between neural activity and behavior
- independently access, organize, and analyze data from public repositories
- use Python programming for fundamental data processing and visualization
- formulate testable hypotheses and conduct data-driven analyses while critically evaluating methodological limitations and biological plausibility
- present findings clearly, concisely, and professionally
- reflect critically on data limitations, potential biases, and reproducibility

Workloadberechnung:
112 h SWS / Präsenzzeit / Arbeitsstunden
44 h Prüfungsvorbereitung
114 h Vor- und Nachbereitung

Bestehen Auswahlmöglichkeiten von Lehrveranstaltungen im Modul?
nein

Unterrichtsprache(n):
Englisch

Modulverantwortliche(r):
Prof. Dr. Julia Veit

Häufigkeit:
Sommersemester, jährlich

Dauer:
1 Semester

Modul gültig seit / Modul gültig bis:
SoSe 26 / -

ECTS-Punkte / Arbeitsaufwand:
9 / 270 Stunden

Modulprüfungen

Modulprüfung: Module examination Recording and Analysis of Neural Data

Prüfungstyp: Modulprüfung

Prüfungsform:
Portfolio gemäß AT § 8 Absatz 8

Die Prüfung ist unbenotet?
nein

Anzahl Prüfungsleistungen / Studienleistungen / Prüfungsvorleistungen:
1 / 1 / -

Prüfungssprache(n):
Englisch

Beschreibung:
1 PL (graded) = oral presentation

1 SL (ungraded) = Portfolio, consisting of protocols (as notebook entries)

Lehrveranstaltungen des Moduls

Lehrveranstaltung: Recording and Analysis of Neural Data

Häufigkeit:
Sommersemester, jährlich

Unterrichtsprache(n):
Englisch

SWS:
8,00

Lehrveranstaltungsart(en):
Vorlesung
Seminar
Praktikum

Zugeordnete Modulprüfung:
Module examination Recording and Analysis of Neural Data