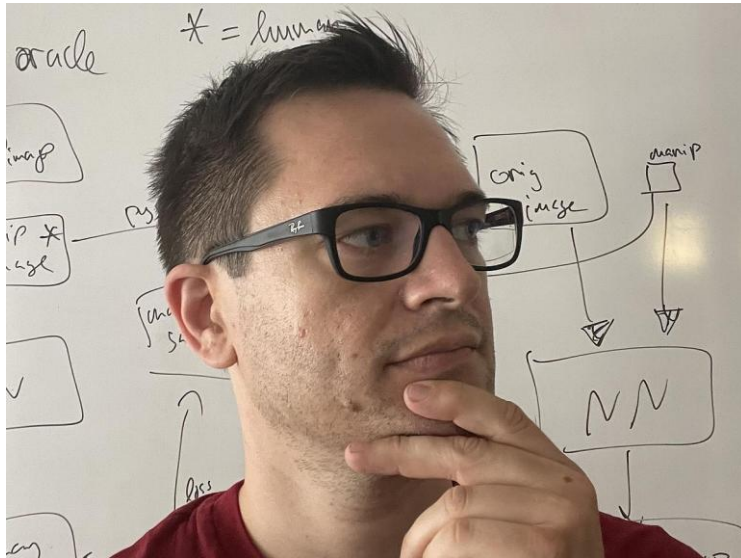


Brain Pattern Recognition - Kickoff

Felix Putze & Matthew White
Bremen 4.08.2025 & 1.9.2025

This is us:



Dr. Felix Putze

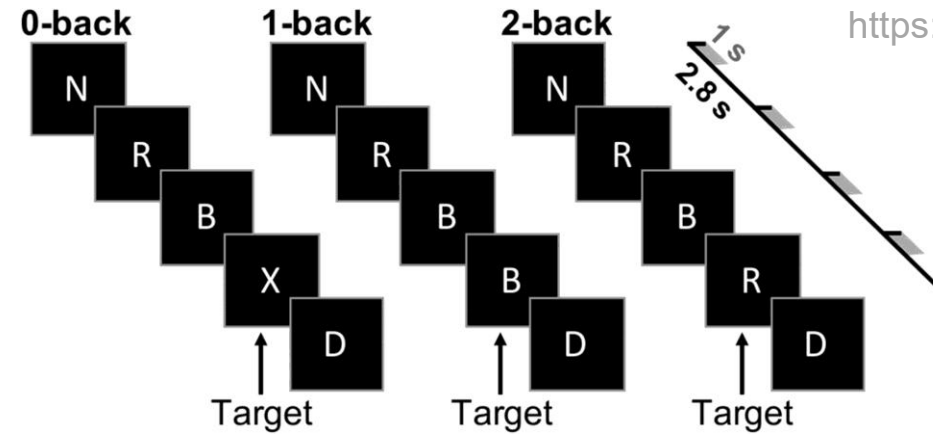


Matthew White

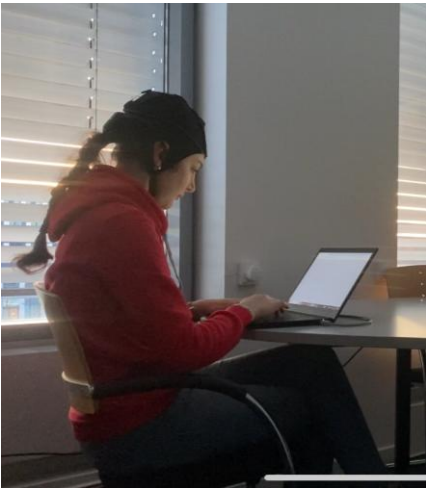
Roadmap

- Main part of course: full-time block course (September 1st-10th)
 - Together with CS students
 - This part is worth 6 CP, you get 9 CP, i.e., you collect 3 CP in the ramp-up phase before
- Gives us great opportunity to prepare the main part and make the most of this focused time
- Goal: Have a fully running, tested experiment and first pilot data available at the start of the course
- Opportunity for voluntary post-course continuation (master project, lab rotation, ...)

Working Memory vs. the Real World



<https://onlinelibrary.wiley.com/doi/10.1002/hbm.24955>



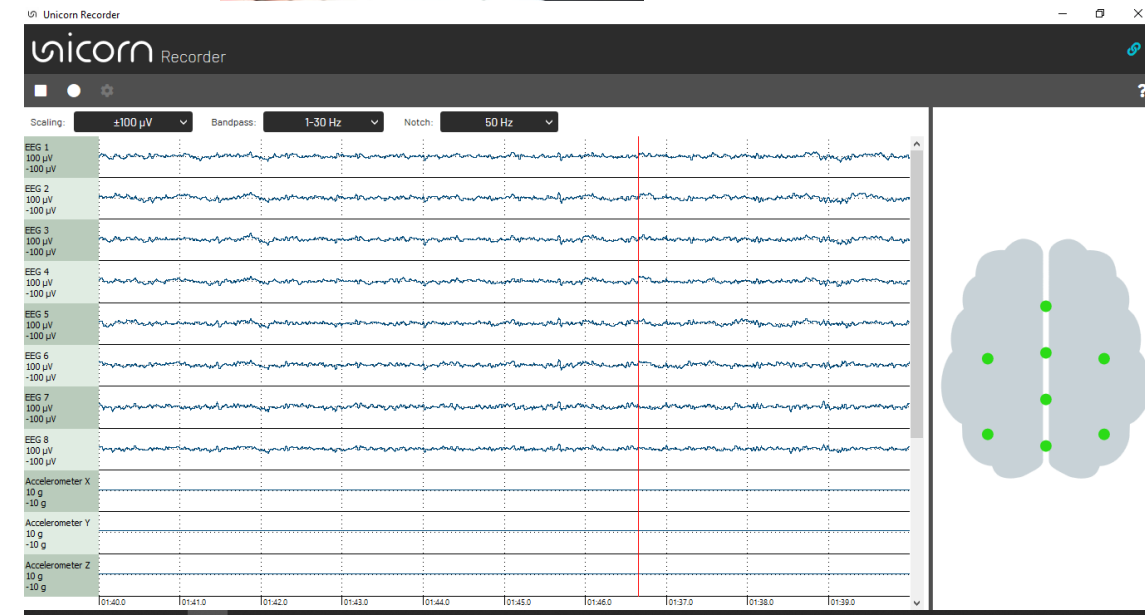
Record neural activity in different environments
(quiet & calm vs. loud & busy)



- Can we discriminate recording environments?
- Can we discriminate different memory tasks?

EEG

- Electroencephalography (EEG) captures electrical activity of the brain through electrodes placed on the skull
- Non-invasive, portable, high temporal resolution, low spatial resolution
- We will use a low-cost, light-weight, mobile, 8-channel device build for quick setup in Brain-Computer Interface applications



Your Tasks

- Prepare experiment protocol (incl. participant instruction, consent form, equipment calibration procedure, trial structure, etc.)
- Familiarize with practical mobile EEG recording
- Perform a few test recording sessions, iron out problems
- We will provide introductory material, paper references, templates, access to the devices

Material

- Guides for using the EEG headset
- Guides for using the recording software LabStreamingLayer + LabRecorder
- Example n-back task
- Example experiment protocol
- Paper about workload classification from EEG

Working Mode

- Join Discord server for communication among group and with us
 - Also nice to easily share resources, tips, etc.
 - <https://discord.gg/RG8qgDMTdj>
- Show us first prototype in the second half of August, have first testing data in at the start of the block course
 - Gives us kickstart for the analysis and systematic data collection in the time-compressed block
- Give ~45 minute presentation (whole group, everybody contributes) to the CS students at the beginning of the block course
 - Theoretical introduction
 - Live demonstration of recording, data, ...



Technical Preparation

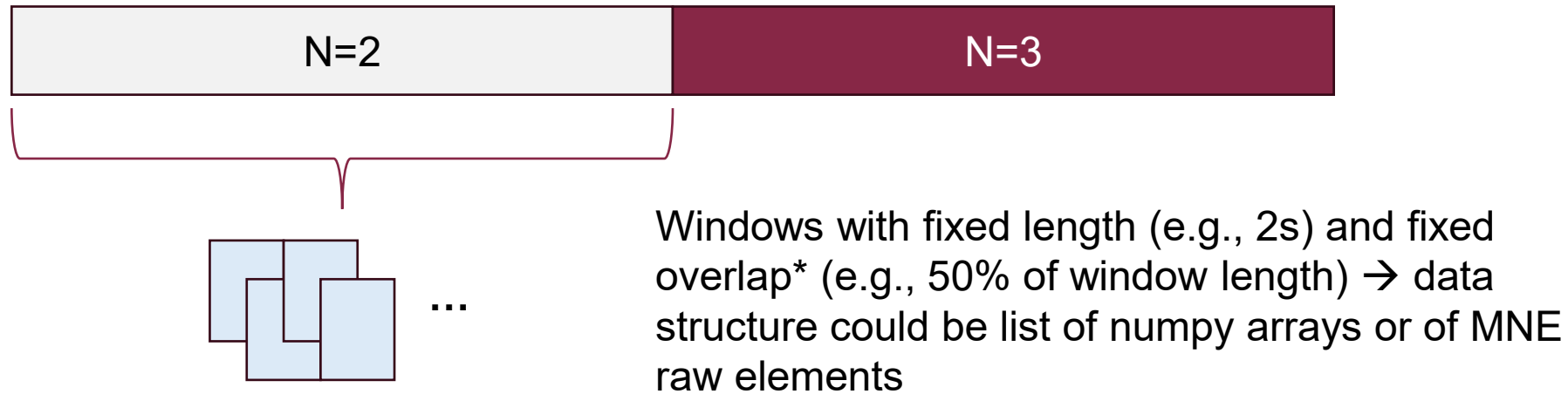
→ Who can bring a laptop to the course?

→ Familiarize with the necessary tools:

- Python & jupyter notebooks
- numPy
- scikit-learn
- pyTorch
- Matplotlib and seaborn
- MNE

Tasks for Today

- Continue data collection
- Load data into a useful data structure
- Plot data as time series (consider filtering!)
- Plot data as Power Spectral Density (PSD)
- Read about different types of BCI machine learning approaches:
 - Feature-based
 - Deep learning



label = [2, 2, 2, 2, ...] ← list of labels representing the N of the respective task

*) If overlap is > 0 , be careful when shuffling the data before splitting in train/test or before crossvalidation, as data leakage may occur! (windows sharing data should not end up in different parts of the split)