Seminars around Brain-Computer Interfaces

For BSc: 4 topics on Foundations of Brain Signals and Brain-Computer Interfaces

For MSc: 8 topics on Algorithms for the Real-Time Decoding of Brain Signals and 5 topics on Advanced Neurotechnological Applications

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www.bsdlab.uni-freiburg.de/teaching/sose19
Control a physical device via BCI:
Spell text using motor imagery:

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Play a chess game using visual attention:
Monitors mental workload:
Brain-Computer Interface (BCI)

• measures brain activity
• decodes brain activity with machine learning methods
• influences / drives an application using the decoded information
• provide visual / auditory feedback
• (stimulate the brain electrically)
Types of tasks?

1. focus of attention to one of several *external stimuli* (visual, auditory, haptic, ...)

2. *self-initiated* mental imagery tasks (motor imagery, calculation, navigation...)

BCI Control Scheme
Examples of EEG recordings

Transient potentials

Oscillations
Types of tasks?

1. focus of attention to one of several *external stimuli* (visual, auditory, haptic, ...)

2. *self-initiated* mental imagery tasks (motor imagery, calculation, navigation...)

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**BCI Control Scheme**

- Patient performs mental tasks.
- Record brain activity.
- Signal preprocessing.
- Feature extraction.
- Classification / regression.
- Application, e.g., for spelling.
- Feedback of e.g., classification result.
- Computer.
- Results.

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Role of machine learning in BCI?
Schedule / Requirements

- Today: we present topics, you list your TOP3
- Next week (April 29-May 3rd): you subscribe via HisInOne, we create a matching between participants and topics. By the end of the week, the matching is fixed and you will be enrolled for the Prüfungsleistung (no leaving the course anymore!)
- Meet your supervisor, pick up initial materials
- Mai 17 (latest): Provide your supervisor with a 2-page resumé (commented table of contents) – course is failed if this deadline is missed.
Schedule / Requirements

- schedule individual meetings with your supervisor to get your talk into shape
- TBD: Talk on how to give a talk
- July 2\textsuperscript{nd} and July 9:
  - one presentation per topic: \textbf{40 min} (25+10+5)
- Active participation in discussions
- One seminar report per topic: \textbf{10 pages}
Schedule / Requirements

- We expect every student to attend both sessions.
- Your reports are due one week after the last presentation session (we expect that you process & include feedback received after your presentation).
- You will receive feedback on your report via your supervisor.
Grading

- 60% presentation
- 30% written report
- 10% contribution in discussions
  (Giving and receiving feedback after presentation will be practiced)
Topics

→ Quick glance on topics
→ Enter your preference as a TOP3 ranking (e.g. B4, B1, B2)