Paolo Burelli

Stefan Heinrich

Morten I. K. Munk

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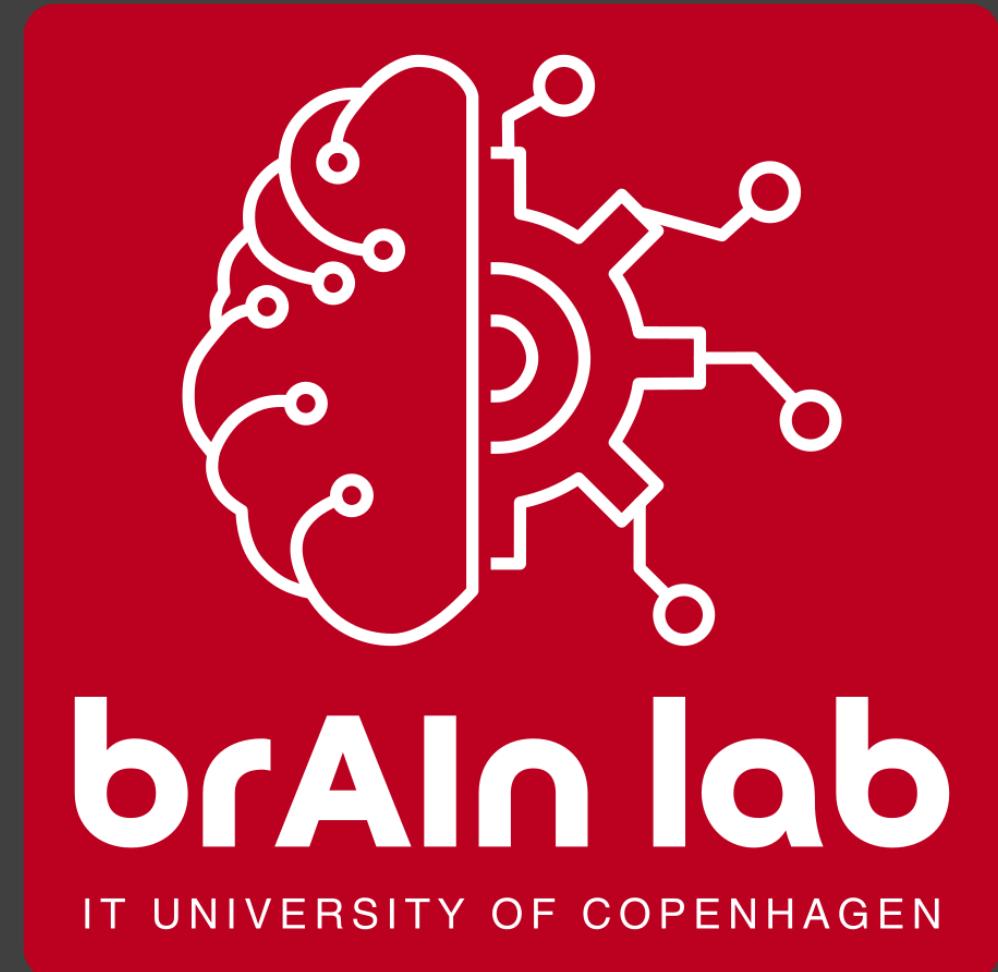
Mihaela Y. Hristova
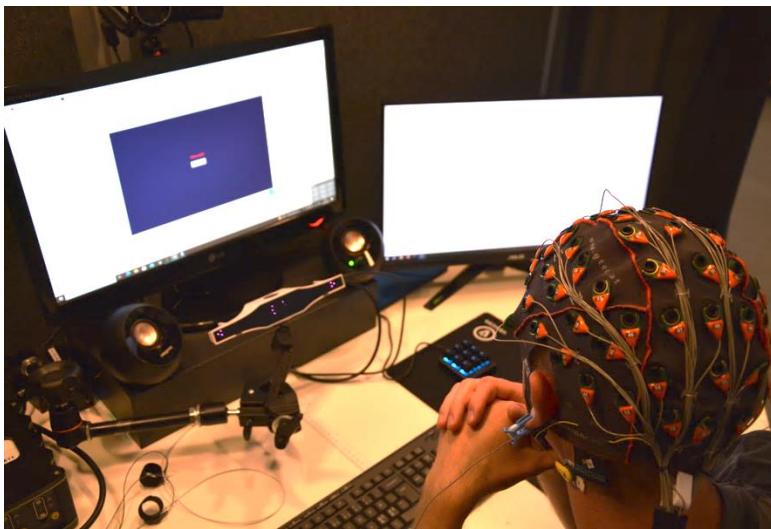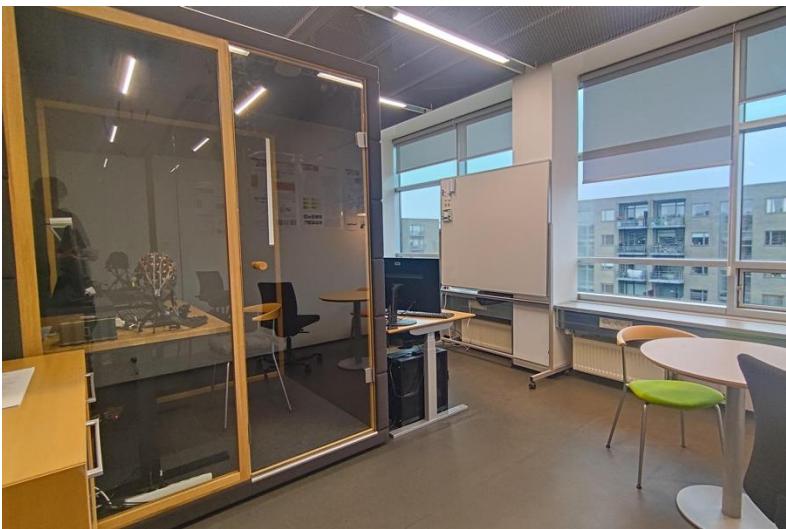
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Topics

- Machine learning
- Psychophysiology
- Neuroscience
- User modelling
- Games

Experiments

- User research
- Usability
- Data collection

Equipment

- EEG
- Eye Tracking
- Hearth Rate Monitoring
- More…?
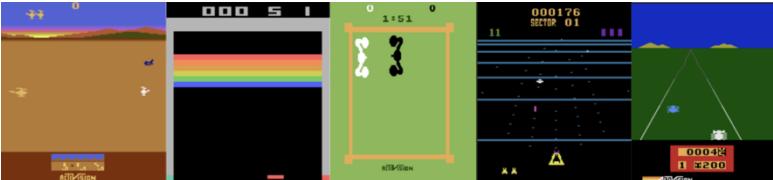
Mind Games: Leveraging EEG Technology for Real-Time Player Experience Feedback in Game Design

BSc Thesis
Christian Alexander Hetling <chrhe@itu.dk>
Erling Amundsen <erla@itu.dk>
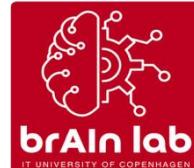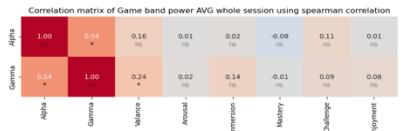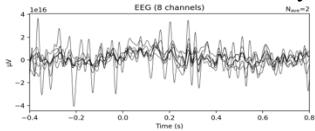
A key aspect of game design is gathering feedback of player experience during testing. Traditionally this has been done using questionnaires, however this approach has certain limits. Mainly that questionnaires are cumulative and retrospective in nature. Gathering user input throughout testing, breaks up game play sessions unnecessarily

In this study we investigate the potential of employing electroencephalogram (EEG) technology as an objective method for collecting feedback on player experience at game time. We explore augmenting EEG recordings with game play questionnaires to build a model of game experience solely from the EEG.


10 participants completed 5 diferent games reporting their experience using the self assessment mannequin and a subset of miniPXI. The collective measures of the questionnaire was used to classify periods of enjoyment, valence, arousal and mastery
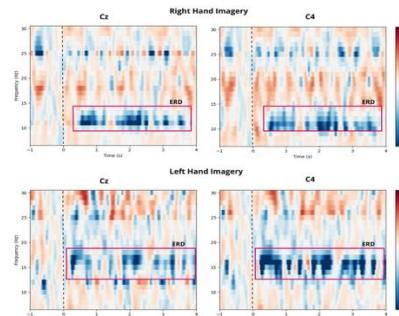
Electroencephalogaming: Multiclass Investigations for Improving Performance of a Motor Imagery Brain Computer Interface

BSc Thesis
Christina Aftzidis <caft@itu.dk>
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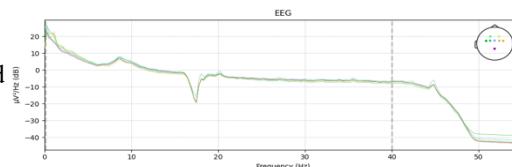
In contrast to traditional input methods - such as keyboard, mouse, and controller - a Brain Computer Interface (BCI) does not require movement from the user, thus having a large background in assistive technologies. Additionally, this technology is a new modality to explore video games, potentially offering an alternative, improved experience for the player.

Amongst these new modalities is the principle of Motor Imagery, in which users imagine a specific movement without executing it, causing detectable brain wave signals in the motor cortex. Brain Computer Interfaces using Motor Imagery, however, require a lot of time to train, as they need to be fine-tuned to the user.

Making use of Principal Component Analysis and Common Spatial Patterns, we build a pipeline for transforming raw EEG data into features usable for a Support Vector Machine to classify diferent Motor Imagery conditions from two different subjects. We show that training time cannot be reduced by using outersubject pre-collected data.
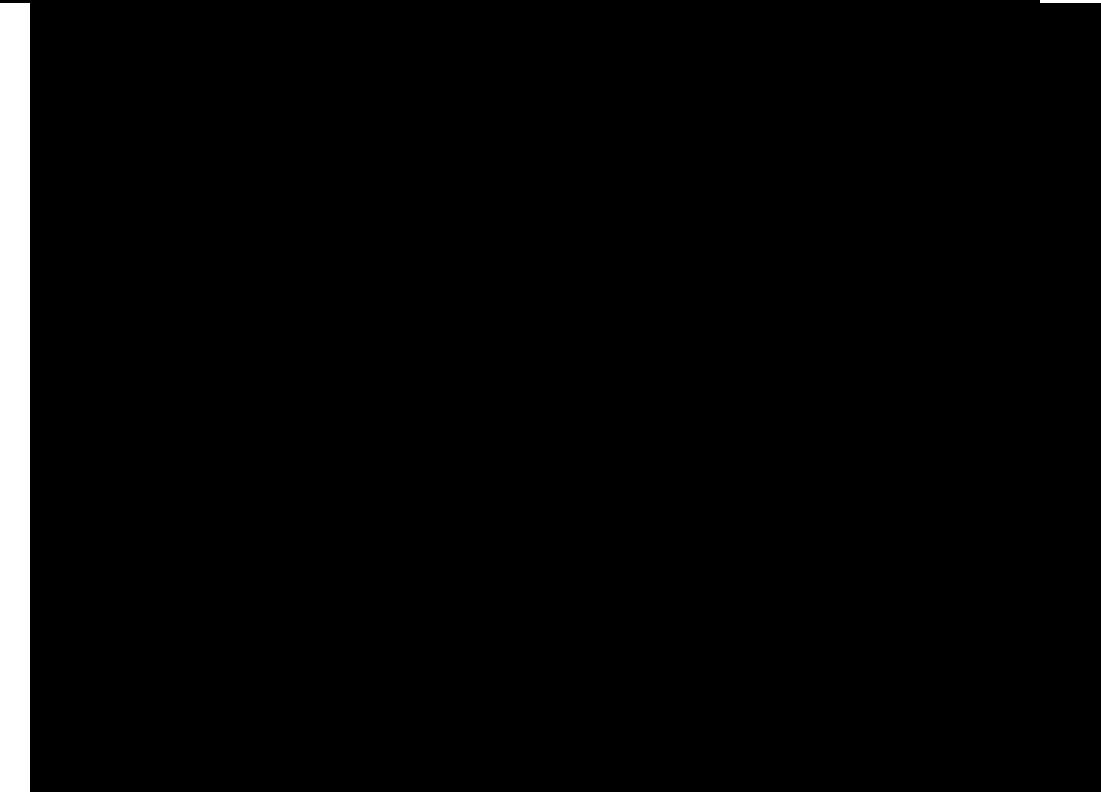
We further show that the performance of an overall classifier may be improved by only taking specific sessions into account or limiting the number of conditions.

Potential Projects

- Investigate deep learning to encode psychophysiological signals (e.g. EEG, Gaze, Pulse) and model brain function:
    - **Stable** geometrical **representation** inference in EEG signal
    - Explainable EEG **transformers** & **autoencoders**

- Test theories of **neuroscience** & **cognitive psychology** for information processing:
    - Multiple timescales in perception & action
    - Hierarchical & statistical learning
    - Mechanisms of neurodiversity

- Create computational models of player experience:
    - Can we detect and qualify different **players' emotions** and **cognitive states** while they are playing?
    - Can we **adapt the gameplay**? Can we **generate new content** driven by the experience? (generative AI in games)

- **Multimodal** affective computing:
    - MLLM: Fusion of Physiological Signals and Dialogue
    - Personality & Load Prediction from Physiological Signals

More projects available at

https://brainlab.itu.dk/thesis-project-ideas/