PROJECT PROPOSAL

Neural Mechanisms of Movie Memory Recognition using EEG

1. Dataset Selection

We have selected the **Essex EEG Movie Memory Dataset (ds006142)** from OpenNeuro for our neuroinformatics analysis project. This dataset, created by Ana Matran-Fernandez and Sebastian Halder at the University of Essex, provides an opportunity to study the neural mechanisms of recognition memory in naturalistic contexts. By using movie clips as stimuli, it allows us to examine how the brain distinguishes between familiar and unfamiliar content, what temporal and frequency dynamics characterize successful memory recognition, How do individual differences (e.g., film engagement) modulate neural responses

2. Dataset Description

2.1 Participants and Technical Specifications

The dataset includes EEG from **27 healthy adults** (ages 21–47, mean ≈ 27). Most were right-handed (92.6%), with a balanced gender distribution (40% female, 60% male).

- **EEG acquisition**: BioSemi ActiveTwo, 64 channels, 2048 Hz sampling rate
- **Data format**: BIDS-compliant EDF files with channel metadata
- **Reference**: CMS/DRL system; all channels marked good quality

2.2 Experimental Paradigm and Behavioral Measures

- **Phase 1**: Participants viewed 10-second movie clips from films they had previously seen, creating natural variance in recognition of success across trials.
- **Phase 2**: They judged recognition (**“Do you recognize the movie?”**) and memory (**“Have you watched it before?”**).
- **Phase 3**: For “yes” responses, clips were replayed, and participants clicked to mark exact recognition times.

Behavioral data include viewing habits, genre preferences, film engagement (merchandise, fan activities, etc.), and social discussion patterns. These measures allow us to relate individual differences to neural responses.

2.3 Event Types

The Dataset includes precisely coded event types

- ***startOfRememberedClipFirstWatch*** – strong memory recognition
- ***startOfRecognisedClipFirstWatch*** – recognition with uncertainty
- ***startOfNotRecognisedClip*** – unrecognized clips

Event timing is precise to the millisecond, enabling accurate alignment with EEG data.

3. Proposed Analyses

1. **Preprocessing:**
    - Remove artifacts (e.g., blinks, muscle noise) and bad channels.
    - Apply filtering and downsampling for efficient analysis.
    - Epoch data around movie clip onset with baseline correction.
2. **Event-Related Potentials (ERPs):**
    - Compare brain responses between recognized and unrecognized clips.
    - Focus on differences in timing and amplitude of key components (e.g., attention and memory-related peaks).
3. **Time-Frequency Analysis :**
    - Explore changes in power across frequency bands (theta, alpha, gamma).
    - Test if recognition is linked with specific oscillatory patterns.
4. **Connectivity (if time allows):**
    - Examine interactions between frontal, temporal, and parietal regions.
    - Look for stronger coupling when participants recognize clips.
5. **Statistics:**
    - Use appropriate tests (t-tests, permutation methods) to validate findings.
    - Relate EEG patterns to behavioral measures like film engagement.

4. Resources

- MATLAB (as used in class) for preprocessing, filtering, and ERP analysis
- EEGLAB toolbox for artifact removal and event-related analysis

5. What the Data Analysis is Expected to Teach Us

1. How the brain responds differently to **familiar vs. unfamiliar movie clips**.
2. What kinds of EEG signals are linked to **successful memory recognition**.
3. How **preprocessing and artifact removal** improve the quality of these signals.

6. Project Timeline

- **Aug 19 – Proposal submission**
    - Dataset selection, familiarization, initial plan.
- **Late Aug – Early Sept**
    - Preprocessing: filtering, artifact removal, downsampling, epoching.
- **Mid Sept – Early Oct**
    - Begin ERP analysis (recognized vs unrecognized clips).
- **Oct – Early Nov**
    - Extend to time-frequency methods .
- **Nov**
    - Explore connectivity and statistical testing.
    - Prepare presentation and final report.