MEG/EEG Data for MI BCI

Contact: Kyungho Won (kyunghowon0712@gist.ac.kr)

Experimental paradigm

Ten subjects (ages:25.3 ± 2.0 yearsold;8males,2females) participated in this study. The experiment was approved by the Institutional Review Board of Gwangju Institute of Science and Technology. All subjects were informed of the experimental process and purpose, and written consent letters were collected from them before the experiment.
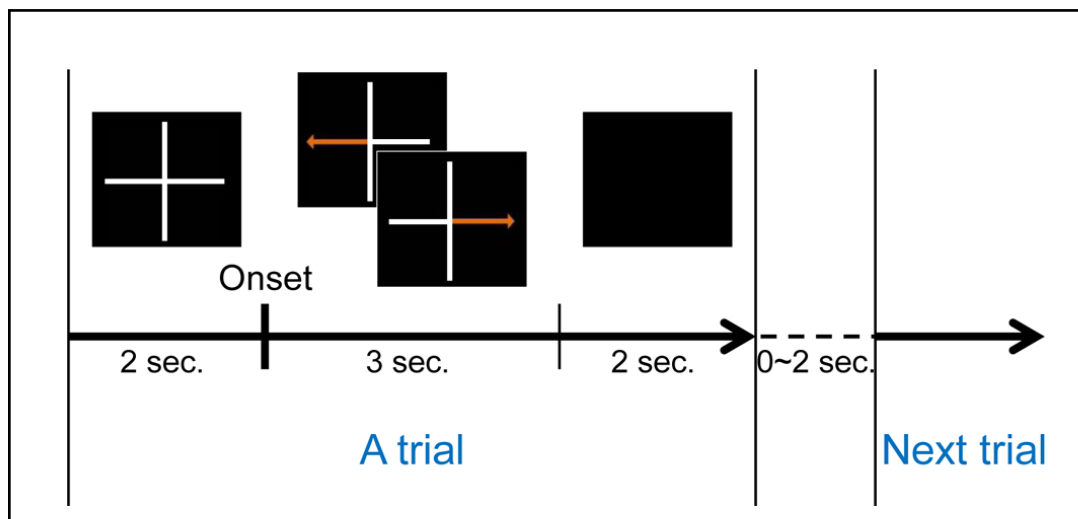

Figure 1. Single trial of MI task

RESTING STATE

Subjects were seated in a comfortable armchair and instructions were projected onto a screen approximately 80 away. The resting state signal was acquired before the MI task .This resting state acquisition lasted 60s, while the subjects did nothing but let their minds wander with eyes open.

MI TASK

A conventional left and right hand imagery movement task was introduced to estimate each subject's MI ability. Each subject conducted three runs during this task. One run consisted of twenty trials for each class (left or right hand movement imagination), for a total of forty trials. A trial began with a gray fixation cross on a black background. Subjects were asked to move their eyes as little as possible during each trial. Either a left or right arrow appeared on the gray fixation cross after 2 s of preparation. The MI phase began with the appearance of a

randomly selected directional arrow, and subjects were instructed to imagine their hand movement, such as making a fist with the left or right hand according to the arrow until it disappeared. The MI phase lasted 3sforeachtrial. Afterward, the screen went blank and subjects were allowed to relax for 2 s. A randomized interval of 0–2s was allocated between consecutive (randomly chosen right or left) trials to avoid subjects' adaptation. Figure 1 illustrates one trial of this MI experiment. A total of 120 trials were collected during the experiments.

Data recording

All experiments were conducted with MEG in a magnetically and electrically shielded room developed by Korea Research Institute of Standards and Science in South Korea (152 channels axial gradiometer, sampling rate: 1 kHz or 512 Hz, notch filtering at 60 Hz and bandpass filtering with 0.1–100 Hz), Biosemi EEG (19 channels electrodes, sampling rate: 512 Hz) and Brain Products EEG (19 channels, sampling rate: 500 Hz, notch filtering at 60 Hz) systems. EEG electrodes were attached to the entire scalp (Fp1, Fp2, F3, F4, C3, C4, P3, P4, O1, O2, F7, F8, T3, T4, T5, T6, Fz, Cz, Pz) according to the 10–20 international system. For three subjects (H, I and J), MEG/EEG was digitized at 1 kHz and down- sampled to 500 Hz using the Brain Products EEG system. Signals were recorded in two different states, the resting state, which is recorded at the beginning of the experiment, and the mental state while performing MI. MEG and EEG were also recorded simultaneously.

Data file description

s1, s2, s3, s4, s5, s6, s7_eeg: EEG data from KRISS

> eeg.openpre: channel x time EEG data (eyes open resting state – pre)
> eeg.closepre: channel x time EEG data (eyes closed resting state – pre)
> eeg.n_trials: # of trials
> eeg.frame: epoch information
> eeg.srate: sampling rate
> eeg.subject: subject ID
> eeg.raw_left: channel x expanded time EEG data (left hand imagery)
> eeg.raw_right: channel x expanded time EEG data (right hand imagery)
> eeg.event: triggers
> eeg.openpost: channel x time EEG data (eyes open resting state – post)
> eeg.closepost: channel x time EEG data (eyes close resting state – post)

s1, s2, s3, s4, s5, s6, s7_meg: MEG data from KRISS

> meg.raw_left: channel x time MEG data (left hand imagery)
> meg.raw_right: channel x time MEG data (right hand imagery)
> meg.n_trials: # of trials
> meg.frame: epoch information
> meg.srate: sampling rate
> meg.event: triggers
> meg.senloc: sensor location
> meg.rest.openpre: channel x time MEG data (eyes open resting state – pre)
> meg.rest.closepre: channel x time MEG data (eyes closed resting state – pre)

meg.rest.openpost: channel x time MEG data (eyes open resting state – post)
meg.rest.closepost: channel x time MEG data (eyes closed resting state – post)

s8, s9, s10_eeg: EEG data from Severance Hospital

eeg.data: channel x time EEG data
eeg.marker: triggers
eeg.n_trials: # of trials
eeg.srate: sampling rate
eeg.senloc: digitized locations
eeg.rest: resting state EEG data
eeg.label: channel labels

s8, s9, s10_meg: MEG data from Severance Hospital

meg.raw_left: channel x time MEG data (left hand imagery)
meg.raw_right: channel x time MEG data (right hand imagery)
meg.n_trials: # of trials
meg.frame: epoch information
meg.srate: sampling rate
meg.event: triggers
meg.target: triggers (left/right hand imagery)