

# Motor Imagery (MI) for the Movement Environment

Contact: Keun-Tae Kim (kim\_kt@korea.ac.kr)

Citation: K.-T. Kim, H.-I. Suk, and S.-W. Lee, "Commanding a Brain-Controlled Wheelchair using Steady-State Somatosensory Evoked Potentials," IEEE Trans. on Neural Systems & Rehabilitation Engineering, 2016. (Accepted)

## Experimental paradigm

Twelve healthy subjects (1 female and 11 male, mean  $\pm$  standard deviation:  $28 \pm 2.5$  [range: 24-34 years]) were recruited for our experiments. Seven subjects (S1, S2, S3, S4, S5, S8 and S10) had BMI experiences, while the other 5 subjects had no experience of BMI before. No subjects reported any neurological disorders. All experiments were conducted according to the principles expressed in the Declaration of Helsinki. This study was reviewed and approved by the Institutional Review Board at Korea University (1040548-KU-IRB-15-9-A-2) and written informed consent was obtained from all participants before the experiments.

We conducted using the MI paradigm, specifically for MI illiterate subjects. The subject concentrated the command displayed on a screen. Each trial started by fixating on a cross in the middle of the screen. After 2 sec, one of three arrows (left, right, and up) randomly appeared on the screen for 5 sec. The subjects imagined movements of the left-hand, the right-hand, and the right-foot according to the arrows displayed on the screen (left, right, and up) based on the arrow direction (Figure 1). During the next 5 sec, a fixation cross appeared on the screen again. We collected 90 trials (30 trials per class) from each subject.

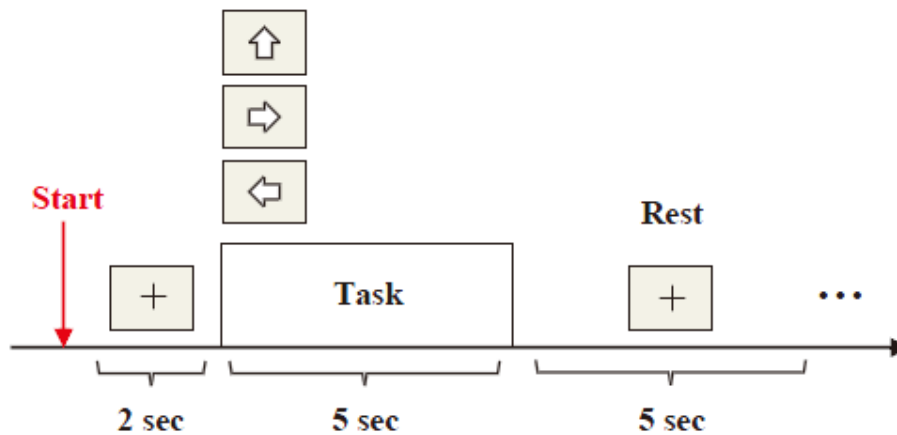


Figure 1. Experimental paradigm for the data acquisition.

## Data recording

EEG signals were acquired via a BrainAmp (Brain Product) device with 30 Ag/AgCl electrodes according to the 10/20 international system (Figure 2). The reference and grounding electrode were mounted on the FCz and Fpz respectively. The sampling frequency rate was 250 Hz, and a 60 Hz notch filter was applied to the EEG signal. All impedances were maintained below 10 k $\Omega$ .

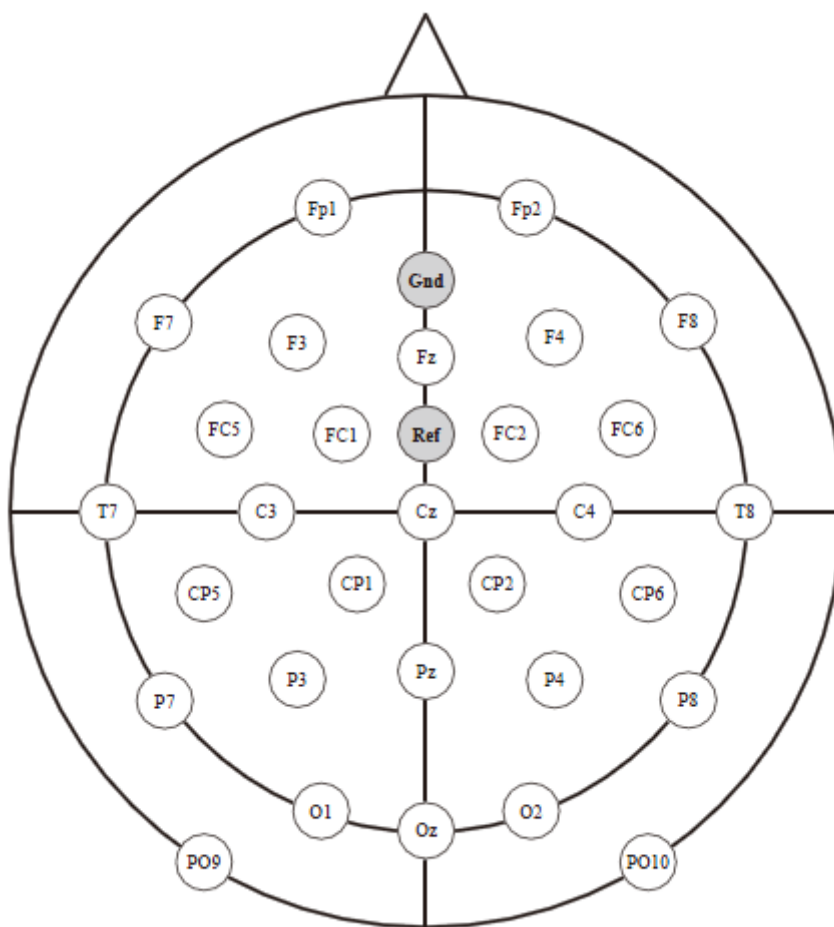


Figure 2. Placements of the 30 electrodes used in our experiment

### Data file description

We provide raw data that can be converted to any form. All data sets are basically stored in the General Data Format for biomedical signals, one file per subject. Each subject in the one folder contains three pieces of data. The EEG data is stored in a binary .eeg file. It consists of 30-channels which all “measured” a sinusoid signal. The files with .vhdr and .vmrk directly belong to the .eeg file specifying additional information. In contrast to the actual data, they are not in a binary format, so you can open them. The vhdr-file contains general additional information and the vmrk file contains name and time point of the markers you see above.