Data Description – EEG(+Ear-EEG)-based ERP detection during walking

Every dataset is publicly available via the Open Science Framework (https://osf.io/pq7vb/?view_only=08e7108d89fd42bab2adbd6b98fb683d). This manual describes data usage. The details of data set description, converted data, sample code, and sample data are described below. You can check contents by referring to the list. The subjects (S1-S15, aged 19-32 years, 11 males and 4 females) were asked to perform ERP paradigm and walk in 1.6 m/s. We recorded scalp-EEG, ear-EEG, EOG, and IMU sensors.

Contents

1. Goal of competition
2. Dataset description
3. Converted data

1. Goal of competition

- The goal of this track of competition is to solve ambulatory classification for practical BCI. To be more specific, enhancing the performance of the ERP classification from scalp-EEG and ear-EEG during walking at 1.6m/s is pursued.

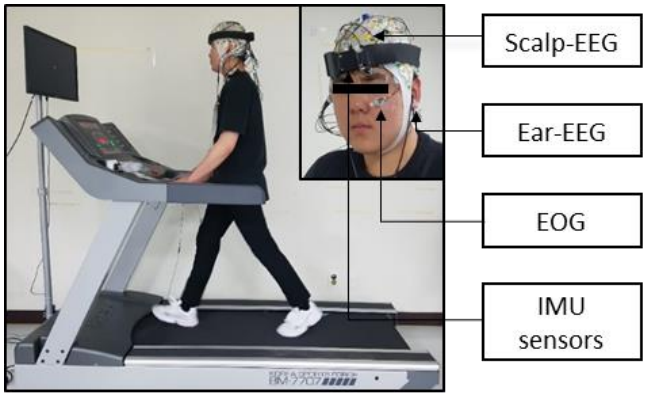
2. Data set description

- The data set is acquired by cue information. Each session has cues as trigger information.
- Channel labels show position of each electrode: scalp-EEG electrodes (1-32), EOG electrodes (33-36), ear-EEG electrodes (37-50), and IMU sensor (51-56)
- Training, validation and test set is divided as the ratio of 0.6, 0.2, and 0.2 of 300 trials.

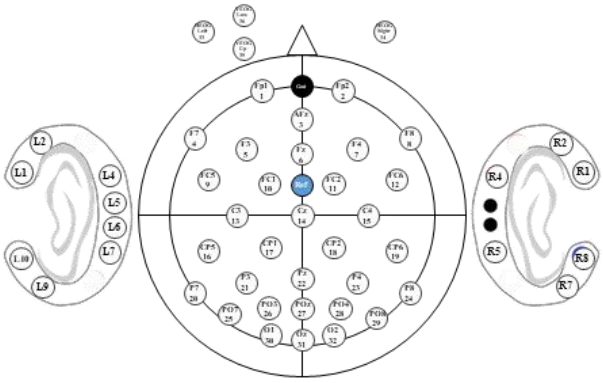
1) Experimental environment and measurement

- We simultaneously collected three different devices; EEG signals from scalp, EEG signals from ear, and forehead IMU signals.
- We collected data when standing and walking in 1.6 m/s on treadmill in front

of a 24inch LCD monitor screen.



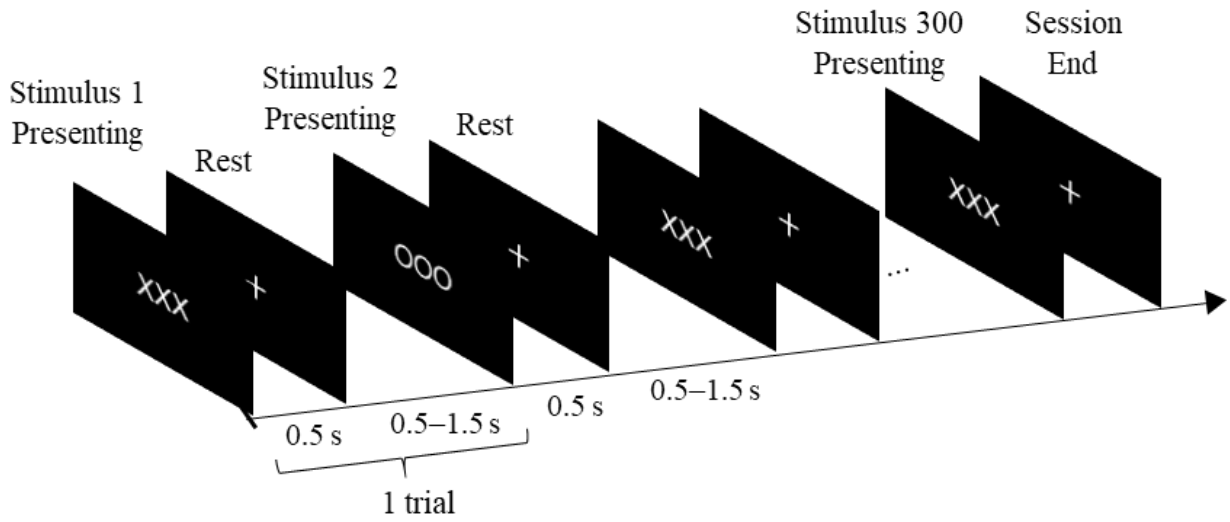
(a) Experiment environment



(b) Channel placement

2)Performed paradigm

- ERP is an electrical potential induced in the central and parietal cortex in response to articular cognitive tasks. Attention on target induces P300 components which have task-relevant peaks 300 ms after a target stimulus.
- In this experiment, this paradigm is executed with target ('OOO') and non-target ('XXX') characters. The ratio of target was 0.2 and the number of total trials is 300. In a trial, a stimulus was presenting for 0.5 s and showing cross to take a rest for randomly 0.5-1.5 s.



(a) ERP paradigm

3) Segmentation

- Each trial is segmented -200ms to 800ms based on the stimulus presenting time.
- And every trial is acquired sequentially same as described in description

figure about paradigm. Among 300 trials, we divided first 180 trials as training, next 60 trials as validation, and the final 60 trials as test dataset.

4) Trigger information

a. Oddball trigger

class	Non-Target	Target
trigger code	S 1	S 2

5) Channel labels

channel	label	channel	label	channel	label	channel	label
1	Fp1	**16**	CP5	**31**	Oz	**46**	R2
2	Fp2	**17**	CP1	**32**	O2	**47**	R4
3	AFz	**18**	CP2	**33**	HEOGL	**48**	R5
4	F7	**19**	CP6	**34**	HEOGR	**49**	R7
5	F3	**20**	P7	**35**	VEOGU	**50**	R8
6	Fz	**21**	P3	**36**	VEOGL	**51**	AccX
7	F4	**22**	Pz	**37**	L1	**52**	AccY
8	F8	**23**	P4	**38**	L2	**53**	AccZ
9	FC5	**24**	P8	**39**	L4	**54**	GyroX
10	FC1	**25**	PO7	**40**	L5	**55**	GyroY
11	FC2	**26**	PO3	**41**	L6	**56**	GyroZ
12	FC6	**27**	POz	**42**	L7		
13	C3	**28**	PO4	**43**	L9		
14	Cz	**29**	PO8	**44**	L10		
15	C4	**30**	O1	**45**	R1		

3. Converted data

- If you want to download data of .mat file, you can download it from `Track5/Training set', `Track5/Validation set', and `Track5/Test set'.

1) Download data from the page below

a. Enter the page below

https://osf.io/pq7vb/?view_only=08e7108d89fd42bab2adbd6b98fb683d

b. Select the file you want and click the download button at the top

2) Description of each file

a. Subject

Uploaded data as subject number ex) sub1, sub2, ..., sub15

b. Recording

Each subject file contains three different files

- epo_tr: training data set
- epo_val: validation data set
- epo_te: test data set
- mnt: montage file of channels

* You can use validation dataset as training as well if you desired.

In a file for a subject,

Name	Description
epo.x	Raw data (time × channels × trials)
epo.fs	Sampling frequency
epo.clab	Channel information
epo.t	Interval time in an epoch
epo.y	Class labels in logic
epo.className	Class name
epo.event	Class labels
epo.x_s	Standing data for each subject (use if you desired)
mnt.x	X coordinates for channel position (only scalp)
mnt.y	Y coordinates for channel position (only scalp)
mnt.pos_3d	3D coordinates for channel position (only scalp)
mnt.clab	Channel information