SSVEP single channel 2018

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Experimental paradigm

This data set consists of EEG data from 20 subjects. The BCI paradigm consisted of two flickering lights (10 Hz and 12 Hz) for eliciting Steady-State Visually Evoked Potentials (SSVEP). The 10 Hz flickering light appeared on the bottom-right of the display and it was associated with the "class 0", while the 12 Hz flickering light appeared on the top-left of the display and it is associated with the "class 1". The visual stimulation was generated with the Espon Moverio BT-200 smart glasses.
A single session on a single days was recorded for each subject. Each session is comprised of 4 runs separated by short breaks. One run consists of 24 trials (12 for each of the two possible classes).

1. the first run actually presented no stimuli, and it was recorded as a sort of baseline [noStimuli];
2. the second run presented one single stimulus at time and the user was asked to stare at it [1stimulus];
3. the third run presented again one single stimulus at time, but the user was asked to stare at a point away from it [interference]
4. the forth run presented two simultaneous stimuli and the user had to stare at one of it [2 stimuli].

The timing scheme of one session is illustrated in Figure 1. Note that due to technical problems the number of trials for the [noStimuli] and [interference] runs could be lower.

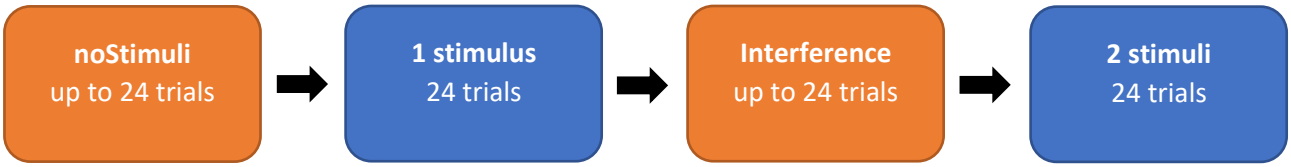

Figure 1. Runs of an experimental session

The subjects were sitting in a comfortable armchair in front of a computer screen. He/she had to press the "start flickering button" when the experimenter said "GO". The order of the flickering frequencies was randomized by the user, but the experimenter ensured that the two classes were balanced at the end of the run. Each trial in a run lasted 10 s.

Data recording

A single differential channel with two active dry electrodes (measuring) and a third passive electrode (reference) were used to record the EEG; the montage is shown in Figure 2. The reference electrode was placed on the right wrist. The signals were nominally sampled at 256 Sa/s, though the actual sampling frequency of the Olimex EEG-SMT resulted closer to 257 Sa/s. Analog band-pass filtering is present on the board (0.1 Hz to 59 Hz). The gain of the amplification stage was adjusted with the second stage gain at 40.588 V/V (TRIM1 set at 1.525 ± 0.005 kΩ). Please refer to the Olimex EEG-SMT open hardware schematics for more electronical details (https://www.olimex.com/Products/EEG/OpenEEG/EEG-SMT/resources/EEG-SMT-SCHEMATIC-REV-B.pdf).

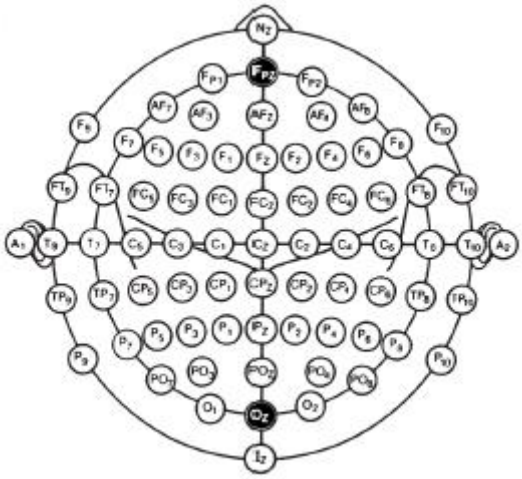

Figure 2. Placement of EEG electrodes according to the International standard framework 10–10 system. The used electrodes locations are reported in black: "Fpz" and "Oz," in the scalp frontal and occipital region, respectively.

Data file description

All data sets are stored in .mat files (Matlab 2020b, but compatible with previous versions). A file exists for each of the 20 subjects and it is named "SXY.mat". The file contains a 1x4 cell array. The content of the cells is: (i) 1Stimulus, (ii) 2Stimuli, (iii) noStimuli, (iv) interference. Each of these cells contains a struct with the following elements:

- "eeg": EEG data 2D array of doubles with dimensions 24x2560, i.e. number of trials (rows) and number of samples acquired in 10 s (columns);
- "y": labels 1D array of doubles with dimensions 24x1, i.e. a label per each trial (rows);
- "classes": 2 strings reminding the classes associated with 0 and 1 values;
- "fs": actual sampling frequency of the Olimex EEG-SMT;
- "gender" of the subject;
- "sight" condition of the subject;
- "age" of the subject;

For more details and evaluation, please see the references below.

References

[1] Angrisani L., Arpaia P., Esposito A. and Moccald, N., 2019. A wearable brain–computer interface instrument for augmented reality-based inspection in industry 4.0. IEEE Transactions on Instrumentation and Measurement, 69(4), pp.1530-1539.

[2] Arpaia P., Duraccio L., Moccaldi N. and Rossi S., 2020. Wearable brain–computer interface instrumentation for robot-based rehabilitation by augmented reality. IEEE Transactions on instrumentation and measurement, 69(9), pp.6362-6371.