N_BACK TEST DATASET

About this dataset

This dataset consists of 6 different files corresponding to the recordings of EEG (electroencephalogram) and ECG (electrocardiogram) activity from 16 subjects under three different mental workloads with their corresponding tests of self-subjective workload perception. To induce workload, subjects were asked to solve three distinct tests using the N-back test game. The order of games was chosen randomly and performed in quite different time sessions.

1. EEG signals were recorded using the EMOTIV EPOC+ 14-electrodes headset. For each electrode, this sensor provides raw-data sampled at 128 Hz and power spectral densities at 8 Hz.
2. ECG signals were recorded using the Suunto Ambit3 Peack Black sensor. This sensor provides breathing rate (BR) and heart rate (HR) at 1 Hz.
3. Subjective data consists of self-subject workload perception answers to TLX questionnaire in Linkert Scale.

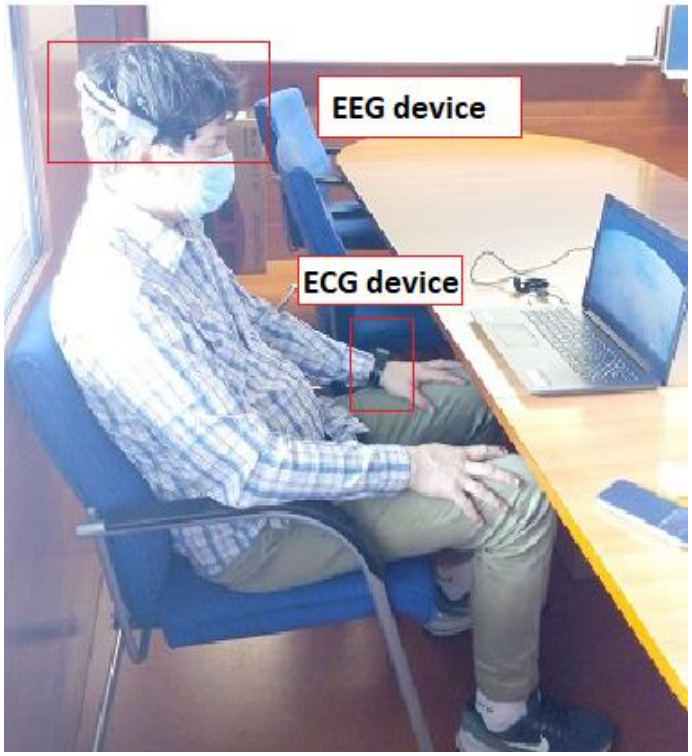

Figure 1. A volunteer during data acquisition process

Files

Recordings are provided into Parquet file format and can be loaded by Python and Matlab.

Folder	Filename	Description
eeg_data	selected_eeg.parquet	EEG data
ecg_data	selected_ecg_br.parquet	Breathing rate data
	selected_ecg_hr.parquet	Heart rate data
	selected_ecg_ibi.parquet	Interbeat interval data
game_performance	selected_game_scores.parquet	Game scores of N-back test
subjective_performance	selected_tlx_aswers.parquet	Answers to TLX questionnaires in Likert scale

Parquets have intuitive column names to select data, the most important are:

- subject: identifies the volunteer. Values: [subject_01:subject_16]
- test: identifies the three different recording sessions for each volunteer. Values: {1 = Low Workload, 2 = Mid Workload, and 3 = High Workload}
- phase: identifies the sequential stage activities during a session. Values: {1 = baseline, 2 = task, and 3 = recovery}

ECG only has 13 subjects, records were discarded due to errors.

Data acquisition process

Recording sessions were separated into 3 phases as follows:

a) Baseline: the subject watches a relaxing video for 10 minutes in order to calm down.
b) Workload: the subject faces the selected N-back test for 20 minutes. According to the required effort to perform the test, the N-back game are categorized as low, medium, and high mental workload.
c) Questionnaire: the subject fills a TLX-questionnaire indicating his/her self-perceived workload.
d) Recovery: likewise in the baseline step, the subject watches a relaxing video for 10 minutes to calm down from the test.

In average, experimental sessions have 48 minutes of duration. Figure 2 outlines the phases of each experimental session.

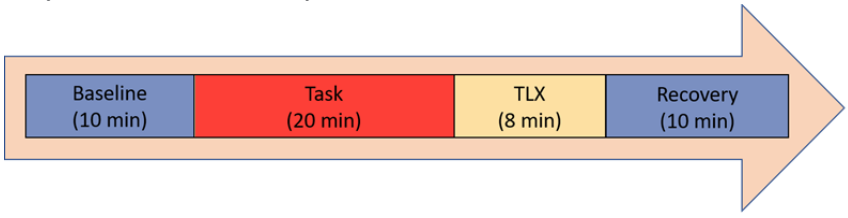

Figure 2. N-back test phases procedure

Subjects solved three variants of the N-Back test to induce low, medium, and high mental workload:

a) TEST 1 “Low workload”: the 1-back position test. It consists of indicating whether or not the position of the highlighted square on screen is the same as the square that appeared before. The subject answers by pressing a key on the keyboard.
b) TEST 2 “Mid workload”: the 1-back arithmetic test. It consists of solving the announced arithmetic operation between the number on screen and number that appeared before. The subject answers by writing the result using the keyboard.
c) TEST 3 “High workload”: the dual arithmetic 2-back test. It encompasses the two previous one tests, simultaneously and considering two positions back.