The AVI SSVEP Dataset

A dataset containing single- and multi-target stimulation EEG for SSVEP responses

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ABOUT THE DATASET

Adnan Vilic's steady-state visually evoked potentials dataset (AVI SSVEP). The AVI SSVEP Dataset, is a free dataset (for non-commercial use) containing EEG measurements from healthy subjects being exposed to flickering targets in order to trigger SSVEP responses. The dataset was produced as a part of a master thesis. All data were recorded using three electrodes (Oz, Fpz, Pz) during winter 2012-2013. The purpose of this dataset is to help non-commercial projects get started with SSVEP responses using real data.

When working with e.g. brain-computer interfaces, there are many things can that can go wrong. Electrodes may not be placed correctly, the subject does for some reason not respond to stimulation, external noise can disturb the signal, the stimulus application may not work as intended or the signal processing algorithm may just not be good enough. Using real data, the developer will know what SSVEP responses are supposed to look like and be able to develop SSVEP detection algorithms before testing on subjects.

Figure 1 shows the setup used for all experiments. The signal electrode is placed at Oz while reference is at Fz and ground at Fpz using the standard 10-20 system for electrode placement. Reference and ground can be set to other positions such as earlobes and mastoids. The right figure shows the hardware setup, where the LCD monitor, BenQ XL2420T, has a refresh rate of 120 Hz. The only processing applied on the data is an analog notch filter at the mains frequency (50Hz).
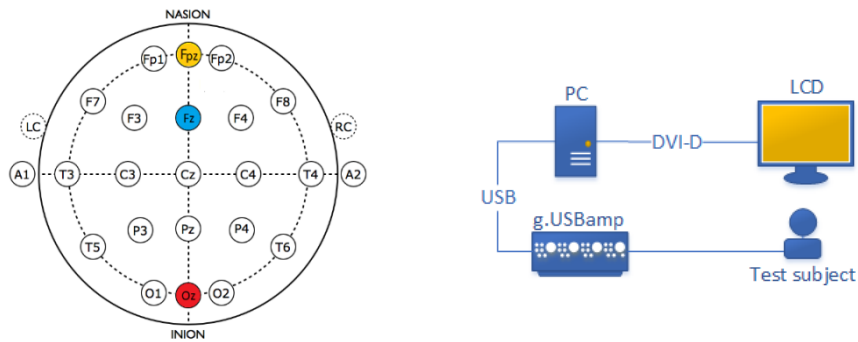

Figure 1: Experimental setup

The data are stored as .MAT files, typically opened using Matlab or Octave. Alternatively, raw EEG and target frequencies are provided in .CSV (comma-separated values) files, which can be opened by any text editor. The difference between the .MAT and the .CSV files are that .MAT files contain more meta-data about the setup (see Table 2 and Table 4).

Note: The datasets contain different subjects, so subject 1 in the single-target dataset may not correspond to subject 1 in the multi-target dataset.

TERMS OF USE

1. The data are supplied only for academic purposes such as scientific analysis or research.

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SINGLE TARGET STIMULATION

In this experiment, the subject is seated 60cm away from a monitor where they look at a single flickering target that changes color rapidly from black to white. The dataset consists of four sessions done with four different test subjects. Each trial in a session lasts for 30 seconds after which the subject takes a brief break. For each of frequency, the trials are repeated at least 3 times. The table below lists the healthy subjects' gender and age.

List of subjects in single target stimulation				
Subject	1	2	3	4
Gender	Male	Male	Male	Female
Age	32	27	27	31

Table 1: List of participants for single target flickering

The table below shows a list of the variables included in each of the four recordings and a full description of each field.

Field	Type	Size	Description
AmpSamlingFrequency	Double		Sampling rate of amplifier.
EEG	Double[]	15360x**C**	Each column, C, contains 30 seconds of EEG data from which SSVEP responses can be derived.
ElectrodePlacement	Char[]	1x2	Electrode position for obtaining SSVEP
RecordedDate	Char[]	1x20	Date of recording.
StimulusDevice	Char[]	1x25	LCD monitor used for flickering
SubjectAge	Char[]	1x2	Age of subject.
SubjectDistance	Char[]	1x5	Distance from monitor
SubjectGender	Char[]	1x1	Gender of subject
TargetFrequency	Double[]	1x**C**	Each column, **C**, contains the flickering frequency that the subject is supposed to look at.
TargetSize	Char[]	1x5	Size of flickering target.

Table 2: Field description for each recording with single target flickering

MULTI-TARGET STIMULATION

Rather than detecting whether there are SSVEP responses, it is more interesting to detect which of multiple targets with different flickering frequencies a person is looking at.

In this experiment, the subject is seated 60cm away from a monitor where they focus at one of multiple flickering target that changes color rapidly from black to white. For each subject, there are two files representing two sessions. Each session has ten trials of sixteen seconds.
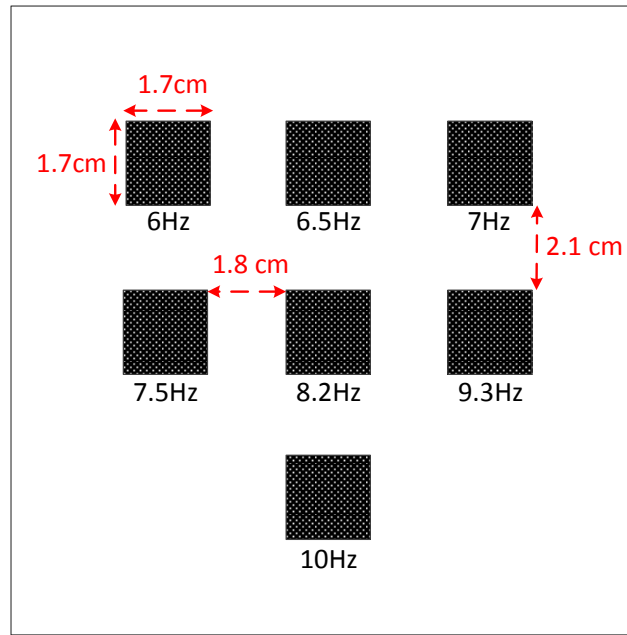

Figure 2: Placement and dimensions of targets in multi-target setup

Figure 2 shows where each flickering target is placed during the experiments and the distance between targets. The minimal requirement for such a setup is that the fovea centralis may not cover two different targets from any given point.

List of subjects in single target stimulation					
Subject	1	2	3	4	5
Gender	Male	Female	Male	Female	Male
Age	32	27	27	27	26

Table 3: List of participants for multi-target flickering

Error! Reference source not found. on the next page shows a list of the variables included in each of the ten recordings and a full description of each field. Each of the ten sessions contains ten trials, resulting in 100 trials or 26 minutes of EEG recordings.

Field	Type	Size	Description
AmpSamlingFrequency	Double		Sampling rate of amplifier.
EEG	Double[]	89120x10	Each column contains 16 seconds of EEG data from which SSVEP responses can be derived.
ElectrodePlacement	Char[]	1x2	Electrode position for obtaining SSVEP
FlickeringFrequencies	Double[]	1x7	All frequencies for targets that are flickering at the same time.
FzImpedance	Double		Impedance at reference in kΩ
OzImpedance	Double		Impedance at signal electrode in kΩ
RecordedDate	Char[]	1x20	Date of recording.
StimulusDevice	Char[]	1x25	LCD monitor used for flickering
SubjectAge	Char[]	1x2	Age of subject.
SubjectDistance	Char[]	1x5	Distance from monitor
SubjectGender	Char[]	1x1	Gender of subject
TargetFrequency	Double[]	1x10	Each column contains the flickering frequency of the target that the subject is supposed to look at.
TargetSize	Char[]	1x5	Size of flickering target.

Table 4: Field description for each recording with multi-target flickering