Description of the Affective Pacman Dataset

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Abstract

1 Introduction

The Affective Pacman (AffPac) dataset was collected [1] to study the effect of mental state on brain-computer interface classifiers [2]. This document provides information to analyze this dataset.

For the experiment, users were asked to play a variant of the Pacman game, where buttons pressed with the left and right index finger turned an constantly moving Pacman character 90 degrees left or right, in order to navigate through the maze. Periodically, the user input was randomly ignored to induce a reduction of control, combined with lagging game play. This resulted in a change in the emotional state of the user, as repeatedly measured with Likert scales on the dimensions valence, arousal and dominance.

2 Sensors and recording

A BioSemi ActiveTwo EEG system was used to record the EEG and physiological signals at a sample rate of 512 Hz. EEG was recorded with 32 Ag/AgCl active electrodes placed at locations of the Extended International 10–20 system. To measure the influence of ocular and muscle artifacts, we recorded the EOG (horizontal and vertical pairs) and two pairs of EMG signals over the left and right flexor digitorum profundus (the muscles used to press with the index finger). Physiological sensors (e.g. for temperature, respiration, the galvanic skin response and the blood volume pulse) were recorded simultaneously, see Table 1 for an overview.

3 Data format

Twelve subjects were recorded, named `S0`...`S11`. Subject `S3` and `S8` didn't allow us to publish their data anonymously, and were omitted from the public dataset.

After recording, the events from the game's logs were synchronized with the trigger channel recorded with the BioSemi system. No additional filtering was performed on the sensor data.

The files contain the following matrices:

Modality	Sensor	Labels	Count
brain activity	EEG	`Fp1...Cz`	32
eye movements	EOG	`EXG1...EXG4`	4
finger movements	EMG	`EMG5...EXG8`	4
skin conductance	GSR	`GSR1`	1
blood pressure, heart rate	plethismograph	`Plet`	1
respiration	respiration belt	`Resp`	1
temperature	thermometer	`Temp`	1

Table 1: An overview of the sensors to be used in the experiment.

X is a $47 \times n$ matrix, containing the EEG data recorded with 47 channels and n samples over time.

chann is a list of the 47 channel labels for the rows of X. See Table 1 for the explanation of the labels. EOG was measured with a horizontal pair of electrodes located about 1 cm outside the outer canthi (`EXG1` on the right side, `EXG2` on the left side for the subject), and a vertical pair around the subject's right eye (`EXG3` on top, `EXG4` on bottom). Channels `GSR2`, `Erg1` and `Erg2` were unused, and contain only noise.

I is a $6 \times n$ matrix, containing per-sample experimental information about time, experimental block, condition and self-reported emotional status. It can be used to extract data for a specific condition, or to relate the ongoing EEG to the self-reported emotional dimensions.

id_lab is a list with the 6 labels for the rows of I.

markers contains the subset of the markers defined in Table 2.

Y is a n-dimensional vector with the markers written to the game. The meaning of the markers is given in Table 2.

4 Download

The data can be downloaded from `https://s3-eu-west-1.amazonaws.com/bcidata.breuderink/reuderink_affpac/reuderink_affpac_sXX.mat.gz`, where `XX` is a placeholder for the subject number. Alternatively, the `EEGtools` Python package[1] can be used to download, unpack and load the data automatically.

References

[1] Boris Reuderink, Anton Nijholt, and Mannes Poel. Affective Pacman: A frustrating game for brain-computer interface experiments. In *Proceedings of the*

[1] See `https://github.com/breuderink/eegtools`.

Marker	Meaning
1	key press with left index finger
2	key press with right index finger
3	key press with left index finger
4	key press with right index finger
5	screen freeze
10	init level
11	next level
12	Pacman avatar died
20	start game
21	end game
22	start normal condition
23	end normal condition
24	start frustration condition
25	end frustration condition
26	start self assessment
27	end self assessment
28	start pause
29	end pause
100–109	valence response
110–119	arousal response
120–129	dominance response

Table 2: The markers used in the Affective Pacman game.

3rd International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN 2009), volume 9 of *Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering*, pages 221–227, May 2009. doi: 10.1007/978-3-642-02315-6_23.

[2] Boris Reuderink, Mannes Poel, and Anton Nijholt. The impact of loss of control on movement BCIs. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 19(6):628–637, December 2011. doi: 10.1109/TNSRE.2011.2166562.