Detection of Pleasant and Unpleasant Emotion Evoked by Visual Stimuli using Neural Network

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Background

- Detection and isolation of human emotion from brain activities has been attracted in various research fields such as neuromarketing.
- A relation between a level of brain activity and pleasant and unpleasant emotions has been studied using Near-infrared spectroscopy (NIRS).

Purpose of this study

Detection of pleasant and unpleasant emotions from NIRS signals

NIRS (Near-infrared spectroscopy)

Near-infrared spectroscopy (NIRS) is a technique for measuring changes in local oxygenated and deoxygenated hemoglobin (oxy-Hb and deoxy-Hb) concentrations.

Measurement method

- NIRS (OMM-3000, Shimazu Co., Kyoto, Japan)
  - Measured position: prefrontal cortex
  - Recording 42 channel

Visual stimuli

- International Affective Picture System (IAPS) is the standardized emotionally evocative subject.
- It has been widely employed in the neuro-functional studies of emotion.

Experimental design

- Picture was selected by IAPS selector
- Arousal Mean: 16.5~8.0
- Valence Mean: 7.0~8.0(Pleasant), 1.0~2.0(Unpleasant)

- Kensuke Katahira: IAPS selector, Tokyo University

Emotion detection using Neural Network

Features

- Previous study Yamamoto showed that a significant difference of pleasant and unpleasant emotion in the brain activity can be appeared in the central part of the frontal lobe.
- In this study... We used oxy-Hb and d(oxy-Hb)/dt signal from central part of the frontal lobe (18 channels) for detection.

Structure of Neural Network

- Neural network is inspired by the way human brain works.
- Use the back propagation algorithm.

Classification method

- Calculates the task area from output of the pleasant and unpleasant unit, Joystick signal.
- Compared pleasant area and unpleasant area in that task.
- Judging from emotion which area in that task evoked.
- Correct rate is defined as the rate of teaching signal and classified signal.

Result

- 8 participants can’t performed enough emotion from result of joystick signal and classification by neural network. Excluded them from evaluation.
- Calculated averaged correct rate each task by 13 participants.

Pleasant and unpleasant emotion can be detected with the accuracy of 70% (average)

- 21 right-handed participants (21 males aged around 22).
- Informed consent was obtained from all participants prior to initiation of the experiments.
- Pleasant and Unpleasant Block arranged at random.