

Research Plan

Analysing Brain Response to Affective Pictures from Electroencephalogram (EEG)

Rationale

In this project, we investigate the relationship between emotion and brain activity using the EEG. The aim is to verify claims on correlates to emotional valence and arousal by previous neurological studies. Applications of such a project include development of more empathic human-computer interfaces which can better respond to human emotional needs. The study could also give us a better understanding of some of the preferences we have in our everyday life since our thoughts and decisions are guided by our emotions.

Hypothesis/ Research Question

Through this experiment, we want to verify what past studies have found about brain activity during various states of valence and arousal, such as the correlation between frontal alpha asymmetry and valence, relationship between valence and midline theta power, or the dominance of beta band waves during increased state of arousal.

Engineering Goals

Familiarise oneself with laboratory environment and procedures of collecting EEG data, develop software to flash pictures and collect EEG data, write programs to analyse data in the form of signals.

Expected Outcome

To be able to look for patterns in brain activity when subjects experience varying degrees of arousal and valence, and to be able to present and communicate these findings with other researchers and interested parties through research report and presentation.

Procedure

The project involves developing the software to show the subjects the pictures, to perform the experiments to properly attach sensors and collect data from participants using EEG, to interpret the signals and analyse the data collected.

Pictures from the IAPS database will be categorised based on levels of arousal and valence. The categories will be divided based on ratings provided in the IAPS manual. Pictures will be presented to the subjects in random order using a program written in C#.

EEG cap and sensors will be placed on the participant's head to collect data while they sit in front of a monitor. Alternately, they will be given time to close their eyes to rest and return their emotional state back to normal, view the IAPS pictures, and then rate how they feel using Self-Assessment Manikins. The experimenter will monitor the brain signals to ensure accurate transmission of signals.

Risk and Safety

See Risk Assessment for Human Participants below.

Data Analysis

We will be analysing power spectral density analysis and Fourier transform of signals to look for patterns of dominance of certain frequency bands. We will also be looking at raw signals to find out patterns of event-related potentials. Power of frequency bands can be calculated as well by filtering the frequency bands, then obtaining power of the filtered signal. We will then compare power values of different bands and different electrodes. All data analysis will be performed on MATLAB.

Discussion of Results/ Conclusion

We can conclude whether or not the findings agree with previous studies. We will discuss which regions are activated/ which frequency bands become dominant when certain emotions are felt. We can also report other findings on brain patterns, and suggest methods to improve the study.

Human Participants Research

Participants

The test subjects will have a fair mix of male and female participants. Participants will be invited by personally asking them to participate in the experiment. Subjects will be asked to rate how they feel after viewing pictures on the computer. This will take between one to two hours for each subject.

Risk Assessment

Participants may feel physically tired during or after the experiment, thus we will divide the experiment into six short sessions in order to provide them with sufficient rest time in between. Gruesome and sexually explicit pictures will be excluded to prevent discomfort or stress. Volunteers will also have the right to back out any time during the experiment.

Benefits

Participants will be able to have the opportunity of contributing to research progress and development by taking part in the experiment.

Protection of Privacy

Participants' personal details will not be published in the study. Only their genders and handedness will be anonymously published on the research paper. Data will be stored based on their index numbers. Only the people involved in this research can view the raw data.

Bibliography

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