 DOI: 10.3217/978-3-85125-467-9-225

A method for estimating emotional arousal changes of a group of individuals during movie screening using SSVEP

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Introduction: Neurocinematics is an emerging research area in neuroscience and passive BCI, which aims to provide new filmmaking techniques by analyzing viewers' brain activities [1]. There are an increasing number of neurocinematics studies that attempt to track temporal changes in cognitive and/or emotional states of the brain during movie screening; e.g., attention, emotional engagement, and cognitive load. However, it is generally difficult to find efficient and robust EEG features that can be used to track brain states over a long period of time. In the present study, we propose a method for estimating changes in emotional arousal of a group of individuals during movie screening, using a new type of visual stimuli that can elicit SSVEP.

Material, Methods and Results: Six male subjects participated in the preliminary experiments. A short video clip (~ 5 min) that was designed to elicit fearful emotion was prepared. Each frame of the movie clip was adjusted for the movie clip to keep a constant luminance throughout the whole screening time. Then, white-noise-like random chromatic dots flickering at 6 Hz were superimposed on the video clip with 20 % transparency, in order to elicit SSVEP responses. The EEG data were recorded at 2048 Hz sampling rate from 12 electrodes (Fp1, Fp2, F3, Fz, F4, Cz, PO3, POz, PO4, O1, Oz and O2). After the EEG recording, each participant was presented with the same video clip again to report two most impressive (most fearful or most arousing) scenes.

The recorded EEG data were downsampled to 512 Hz, and the temporal changes in spectral power at 6 Hz were evaluated using fast Fourier transform (FFT) with a 10-second moving window (90 % overlap). The spectral power series were averaged across channels O1, Oz, and O2, and then grand averaged over all study participants. The preliminary result of the averaged SSVEP responses during screening the 'fear' video clip is depicted in Fig. 1, where the overall temporal pattern of the SSVEP power changes coincided well with the questionnaire result.

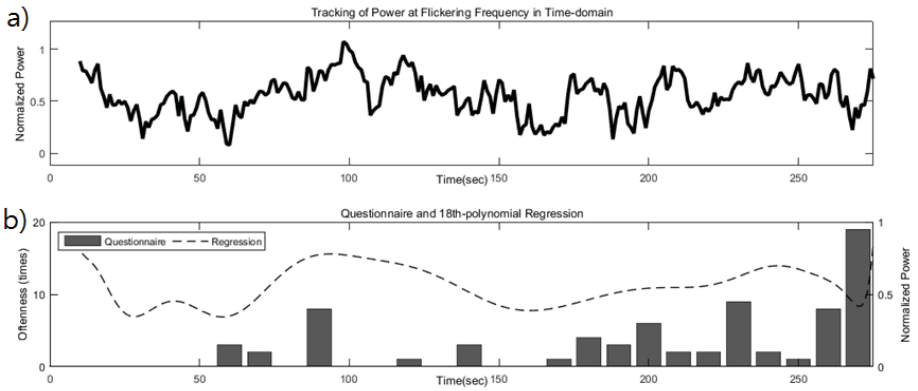

Figure 1. *Changes in normalized SSVEP power during watching 'fear' video: a) Grand averaged SSVEP power changes; b) Result of 18th-order polynomial regression of the power change (dashed line) presented with the questionnaire result (bar graph).*

Discussion: In this study, we proposed a new method for estimating emotional arousal changes of a group of individuals during movie screening by overlaying SSVEP stimuli on the original video clips. Our preliminary experimental results coincided well with a previous SSVEP study that reported the positive correlation between the SSVEP amplitude and the emotional arousal [2]. Further studies with more video clips and participants will be conducted soon, and the results will be presented at the conference.

Significance: Our preliminary results showed the possibility that a new SSVEP-based visual stimulation method might be used to track continuous emotional arousal changes of a group of individuals during movie screening.

Acknowledgements: This study was supported by the National Research Foundation of Korea (NRF) grants funded by the Korea Government (MSIP) (Nos. 2014R1A2A1A11051796 & NRF-2015R1C1A1A02037032)

References

[1] Hasson U, Landsman O, Knappmeyer B, Vallines I, Rubin N, Heeger DJ. Neurocinematics: The neuroscience of film. *Projections* 2(1):1-26, 2008

[2] Keil A, Gruber T, Müller MM, Moraatti S, Stolarova M, Bradley MM, Lang PJ. Early modulation of visual perception by emotional arousal: Evidence from steady-state visual evoked brain potentials. *Cognitive, Affective & Behavioral Neuroscience*, 3(3) 195-206, 2003