Electroencephalographic Signals and Emotional States for Tactile Pleasantness Classification

Miguel A. Becerra[1]
Edwin Londoño Delgado[3]
Sonia M. Pelaez Becerra[3]
Andrés Eduardo Castro Ospina[2]
Cristian Mejia Arboleda[2]
Julián Durango[3]
Diego H. Peluffo Ordóñez[4]

[1]Institución Universitaria Pascual Bravo, Medellín, Colombia. migb2b@gmail.com
[2]Instituto Tecnológico Metropolitano, Medellín, Colombia.
[3]Institución Universitaria Salazar y Herrera, Medellín, Colombia.
[4]SDAS Research Group, Yachay Tech, Urcuquí, Ecuador. http://www.sdas-group.com/

Abstract

Haptic textures are alterations of any surface that are perceived and identified using the sense of touch, and such perception affects individuals. Therefore, it has high interest in different applications such as multimedia, medicine, marketing, systems based on human-computer interface among others. Some studies have been carried out using electroencephalographic signals; nevertheless, this can be considered few. Therefore this is an open research field. In this study, an analysis of tactile stimuli and emotion effects was performed from EEG signals to identify pleasantness and unpleasantness sensations using classifier systems. The EEG signals were acquired using Emotiv Epoc+ of 14 channels following a protocol for presenting ten different tactile stimuli two times. Besides, three surveys (Becks depression, emotion test, and tactile stimuli pleasant level) were applied to three volunteers for establishing their emotional state, depression, anxiety and the pleasantness level to characterize each subject. Then, the results of the surveys were computed and the signals preprocessed. Besides, the registers were labeled as pleasant and unpleasant. Feature extraction was applied from Short Time Fourier Transform and discrete wavelet transform calculated to each sub-bands (δ, θ, α, β, and γ) of EEG signals. Then, Rough Set algorithm was applied to identify the most relevant features. Also, this technique was employed to establish relations among stimuli and emotional states. Finally, five classifiers based on the support vector machine were tested using 10-fold cross-validation achieving results upper to 99% of accuracy. Also, dependences among emotions and pleasant and unpleasant tactile stimuli were identified.

Keywords: *Electroencephalographic signal, Sensorial stimulus Signal, processing, Tactile pleasantness*