

### ABSTRACT

Identifying gender has become essential specially to support automatic human-computer interface applications and to customize interactions based on affective responses. The electroencephalogram (EEG) has been adopted for recording the neuronal information as waveforms from the scalp. The objective of this study was twofold. First, to identify genders from four different emotional states using spectral relative power biomarkers. Second, to develop Spectro-spatial profiles that afford additional information for gender identification using emotional-based EEGs. The dataset has been collected from ten healthful volunteer students from the University of Vienna while watching short emotional audio-visual clips of angry, happiness, sadness, and neutral emotions. Wavelet (WT) has been used as a denoising technique, the spectral relative power features of delta ( $\delta$ ), theta ( $\theta$ ), alpha ( $\alpha$ ), beta ( $\beta$ ) and gamma ( $\gamma$ ) were extracted from each recorded EEG channel. In the subsequent steps, analysis of variance (ANOVA) and Pearson's correlation analysis were performed to characterize the emotional-based EEG biomarkers towards developing the Spectro-spatial profile to identify gender differences. The results show that the spectral set of features may provide and convey reliable biomarkers for identifying Spectro-spatial profiles from four different emotional states. EEG biomarkers and profiles enable more comprehensive insights into various human behavior effects and as an intervention on the brain. The results revealed that almost high relative powers from all emotional states appear in females compared to males. Particularly,  $\delta$  was the most prominent for anger,  $\alpha$  and  $\beta$  were widely observed in happiness,  $\delta$  was the most appears in sadness,  $\theta$  and  $\gamma$  were the powers that appears widely in neutral. Moreover, in females,  $\delta$  was correlated with  $\alpha$  and  $\beta$ ,  $\theta$  was mostly correlated with  $\alpha$ . Besides,  $\delta$  was correlated with  $\alpha$ ,  $\theta$  was correlated with  $\alpha$ ,  $\theta$  was mostly correlated with  $\alpha$ . Moreover, in males,  $\delta$  showed a very strong correlation with  $\alpha$  whereas  $\theta$  was correlated with  $\alpha$  and  $\theta$  was correlated with  $\alpha$ . Therefore, the proposed system using the WT denoising method, spectral relative power markers, and the Spectro-spatial profile plays a crucial role in characterizing the emotional-based EEGs towards gender identification. The classification results were 89.46% for SVM and 90% for the KNN. Therefore, the proposed system using the WT denoising method, spectral relative powers features, SVM, and KNN classifiers were crucial in gender identification and characterizing the emotional EEG signals.

**Keyword:** Sentiment analysis; Depression detector; Mental health; Music therapy; Mood; Natural language