Frequency study of facial electromyography signals with respect to emotion recognition

Abstract

Emotional intelligence is one of the key research areas in human-computer interaction. This paper reports the development of an emotion recognition system using facial electromyogram (EMG) signals focusing the ambiguity on the frequency ranges used by different research works. The six emotional states (happiness, sadness, fear, surprise, disgust, and neutral) were elicited in 60 subjects using audio visual stimuli. Statistical features were extracted from the signals at high, medium, low, and very low frequency levels. They were then classified using four classifiers – naïve Bayes, regression tree, K-nearest neighbor, and fuzzy K-nearest neighbor, and the performance of the system at the different frequency levels were studied using three metrics, namely, % accuracy, sensitivity, and specificity. The post hoctests in analysis of variance (ANOVA) indicate that the features contain significant emotional information at the very low-frequency range (<0.08 Hz). Similarly, the performance metrics of the classifiers also ensure better recognition rate at very low-frequency range. Though this range of frequency has not been used by researchers, the results of this work indicate that it should not be ignored. Further investigation of the very low frequency range to identify emotional information is still in progress.