World Academy of Science, Engineering and Technology
International Journal of Cognitive and Language Sciences
Vol:15, No:05, 2021

# Classifying Affective States in Virtual Reality Environments Using Physiological Signals

**Authors :** Apostolos Kalatzis, Ashish Teotia, Vishnunarayan Girishan Prabhu, Laura Stanley

**Abstract :** Emotions are functional behaviors influenced by thoughts, stimuli, and other factors that induce neurophysiological changes in the human body. Understanding and classifying emotions are challenging as individuals have varying perceptions of their environments. Therefore, it is crucial that there are publicly available databases and virtual reality (VR) based environments that have been scientifically validated for assessing emotional classification. This study utilized two commercially available VR applications (Guided Meditation VR™ and Richie's Plank Experience™) to induce acute stress and calm state among participants. Subjective and objective measures were collected to create a validated multimodal dataset and classification scheme for affective state classification. Participants' subjective measures included the use of the Self-Assessment Manikin, emotional cards and 9 point Visual Analogue Scale for perceived stress, collected using a Virtual Reality Assessment Tool developed by our team. Participants' objective measures included Electrocardiogram and Respiration data that were collected from 25 participants (15 M, 10 F, Mean = 22.28 □ 4.92). The features extracted from these data included heart rate variability components and respiration rate, both of which were used to train two machine learning models. Subjective responses validated the efficacy of the VR applications in eliciting the two desired affective states; for classifying the affective states, a logistic regression (LR) and a support vector machine (SVM) with a linear kernel algorithm were developed. The LR outperformed the SVM and achieved 93.8%, 96.2%, 93.8% leave one subject out cross-validation accuracy, precision and recall, respectively. The VR assessment tool and data collected in this study are publicly available for other researchers.

**Keywords :** affective computing, biosignals, machine learning, stress database
**Conference Title :** ICACII 2021 : International Conference on Affective Computing and Intelligent Interaction
**Conference Location :** Paris, France
**Conference Dates :** May 17-18, 2021