

Abstract

Brain Computer Interface (BCI) is a direct communication channel between the brain and the environment. Signals from the brain are used to either gauge *mental state* or drive external devices; i.e., the BCI acts as a *sensor* or as an *actor*. This project titled **EEG based Human Emotion Classification** is aimed at classifying emotional states using electroencephalogram (EEG) signals of the Human Brain. Recognition of human emotional states paves the path to the implementation of a BCI as a sensor. This is a step towards providing 'Assistance-As-Required' service for the users of intelligent assistive devices such as an intelligent wheelchair, intelligent artificial limbs or intelligent exo-skeletons.

Classification of emotional states was performed. Two classification tasks: Low/High Valence classification and Low/High Arousal Classification were explored. The Valence parameter determines emotional states ranging from unhappy/sad to happy/joyful. The Arousal parameter determines emotional states ranging from calm/bored to excited/stimulated. Classification experiments were performed over EEG data acquired from the publicly available **DEAP** dataset.

Preliminary classification experiments were conducted using derived features of the bispectrum of EEG pertaining to FP1 and FP2 channels. LS-SVM (Linear kernel) and ANN (Error backpropagation) classifiers were used. Observations revealed that the last 30 seconds and filtered rhythms (Theta, Alpha, Beta) of the EEG were significant for discriminating between emotional states. Further experiments were conducted by performing sequential feature selection to obtain reduced feature sets and hyperparameter optimization of the LS-SVM RBF kernel.

Averaged cross-validated classification accuracies of **61.17%** for Low/High Valence Classification and **64.84%** for Low/High Arousal Classification were obtained; comparable to the classification accuracies reported in the literature for DEAP dataset (EEG modality) i.e **57.6%** for Low/High Valence Classification and **62%** for Low/High Arousal Classification.