

Brain machine interface: Classification of mental tasks using short-time PCA and recurrent neural networks

Abstract

Brain machine interface provides a communication channel between the human brain and an external device. Brain interfaces are studied to provide rehabilitation to patients with neurodegenerative diseases; such patients lose all communication pathways except for their sensory and cognitive functions. One of the possible rehabilitation methods for these patients is to provide a brain machine interface (BMI) for communication, using the electrical activity of the brain detected by scalp EEG electrodes. Classification of EEG signals extracted during mental tasks is a technique for designing a BMI. In this paper a BMI design using five mental task EEG signals from two subjects were studied, a combination of two tasks is studied per subject. An Elman recurrent neural network is proposed for classification of EEG signals. Principal component analysis is used for extracting features from the EEG signals. The EEG signal is classified into two tasks. Ten such task combinations are studied. Average classification accuracies varied from 75.5% to 100% with a testing error tolerance of 0.05. The classification performance of the proposed algorithm is found to be better compared to our earlier work using AR model features.