

Developing a Deep Neural Network for Driver Fatigue Detection Using EEG Signals Based on Compressed Sensing

ABSTRACT

In recent years, driver fatigue has become one of the main causes of road accidents. As a result, fatigue detection systems have been developed to warn drivers, and, among the available methods, EEG signal analysis is recognized as the most reliable method for detecting driver fatigue. This study presents an automated system for a two-stage classification of driver fatigue, using a combination of compressed sensing (CS) theory and deep neural networks (DNNs), that is based on EEG signals. First, CS theory is used to compress the recorded EEG data in order to reduce the computational load. Then, the compressed EEG data is fed into the proposed deep convolutional neural network for automatic feature extraction/selection and classification purposes. The proposed network architecture includes seven convolutional layers together with three long short-term memory (LSTM) layers. For compression rates of 40, 50, 60, 70, 80, and 90, the simulation results for a single channel recording show accuracies of 95, 94.8, 94.6, 94.4, 94.4, and 92%, respectively. Furthermore, by comparing the results to previous methods, the accuracy of the proposed method for the two-stage classification of driver fatigue has been improved and can be used to effectively detect driver fatigue.