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Subtractive fuzzy classifier based driver drowsiness levels classification using EEG

Abstract

Driver drowsiness is one of the major causes for several road accidents over the world. In this study, Electroencephalogram (EEG) signals were acquired using 14 electrodes from 50 subjects. All the electrodes are placed on the driver scalp based on International 10/20 standard and Butterworth 4 th order filter was used to remove the noise and artifact. Four EEG frequency bands (delta, theta, alpha, and beta) were analyzed on this work and extracted using Discrete Wavelet Packet Transform (DWPT). Fast Fourier Transform (FFT) was used to extract two statistical features such as spectral centroid and power spectral density (PSD) from the above frequency bands. Subtractive fuzzy classifier was used to map the extracted features into four different driver drowsiness levels namely, awake, drowsy, high drowsy and sleep stage1. As a result of this study points out the best average accuracy achieved by subtractive fuzzy inference classifier is 84.41% based on power spectral density feature extracted by 'db4' wavelet function.

Keywords — Discrete wavelet transform; EEG; fast fourier transform; fuzzy inference system