Title:
EEG Based Drowsiness Detection Using Relative Band Power and Short-Time Fourier Transform

Journal:
Journal of Robotics, Networking and Artificial Life, Volume 7, Issue 3, December 2020

Document Type:
Journal (Open Access)

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Full text link:
Publisher : http://www.warse.org/IJETER/static/pdf/file/ijeter203892020.pdf

Scopus preview
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091841169&doi=10.30534%2fijeter%2f2020%2f203892020&partnerID=40&md5=be8f4f125edc8a9e7fa7140416249b4b

Citation:
Krishnan, P., Yaacob, S., Krishnan, A.P., Rizon, M., Ang, C.K. EEG based drowsiness detection using relative band power and short-time fourier transform (2020) *Journal of Robotics, Networking and Artificial Life*, 7 (3), pp. 147-151. DOI: 10.2991/jrnal.k.200909.001

Abstract:
Sleeping on the wheels due to drowsiness is one of the major causes of death tolls all over the world. The objective of this research article is to classify drowsiness with alertness based on the Electroencephalogram (EEG) signals using spectral and band power features. A publicly available ULg DROZY database used in this research. Algorithms are developed to extract the five EEG channels from the raw multimodal signal. By using a higher-order Butterworth low pass filter, the high-frequency components above 50 Hz are removed. Another bandpass filter bank separates the raw signals into eight sub-bands, namely delta, theta, low alpha, high alpha, low beta, mid beta, high beta and gamma. During pre-processing step, the signals are segmented into an equal number of frames. An overlap of 50% and a frame duration of 2 s using a rectangular time windowing approach segments the signal into frames. Then, the feature extraction algorithm extracts the relative band power features based on the short-time Fourier transform for each frame. The extracted feature sets are further normalized and labelled as drowsy and alert and then combined to form the final dataset. K-fold cross-validation method is used. The dataset is trained using K-Nearest Neighbor algorithm (KNN) and support vector machine classifiers, and the results are compared. The KNN classifier produces 96.1% (dataset 1) and 95.5% (dataset 2) classification accuracy