Title	“Discriminance Analysis of Ongoing EEG to Detect Drivers Sleepiness”
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Abstract

Many test methods for the evaluation of sleepiness are not applicable to subjects which are under conditions of sustained attention, such as driving a car. Here, the analysis of patterns in spontaneously occurring signals seems to be a nearly compulsory way. Image processing solutions, gaining e.g. information of eye and lid movements or of mimic movements or of vehicle movements with respect to road parameters, are desirable for applications. They are, however, weaker coupled to the causes of central fatigue than electrophysiological measures, especially the electroencephalogram. Therefore, a reliable evaluation of drowsiness from the ongoing EEG seems to be more promising, but until now it is not solved satisfactorily. Many authors reported of high interindividual variations and low reproducibility.

We investigated sleepiness of 12 young volunteers (age range 18 - 27 years) during overnight driving simulation tasks from 1 a.m. until 7 a.m. Sleepiness was self-rated using Karolinska Sleepiness Scale (KSS) before and after each of five driving sessions (duration 35 min) and every 120 sec during driving. Rating was given orally. As an additional measure of sleepiness the number of microsleep events (#MSE) in the actual time interval was used. These MSE were scored visually using video recordings by looking for prolonged eye closures, driving incidents and other signs. Doubtable events were taken into account, but with low weight. For preliminary analysis we simplified sleepiness scores into two categories: low and high sleepiness using the KSS or the #MSE values or both.

Power spectral densities and entropy values after wavelet decomposition were calculated of EEG segments. These parameters were used as input values of several machine learning algorithms to test if correct assignments to both sleepiness categories are possible. We obtained mean test errors of lower than 7 % using 140 sec long EEG segments. Results show that machine learning algorithms are capable of dealing with interindividual variations and that the spontaneous EEG contains enough information to detect drowsiness.