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Drowsiness detection during different times of day using multiple features

Abstract

Driver drowsiness has been one of the major causes of road accidents that lead to severe trauma, such as physical injury, death, and economic loss, which highlights the need to develop a system that can alert drivers of their drowsy state prior to accidents. Researchers have therefore attempted to develop systems that can determine driver drowsiness using the following four measures: (1) subjective ratings from drivers, (2) vehicle-based measures, (3) behavioral measures and (4) physiological measures. In this study, we analyzed the various factors that contribute towards drowsiness. A total of 15 male subjects were asked to drive for 2 h at three different times of the day (00:00–02:00, 03:00–05:00 and 15:00–17:00 h) when the circadian rhythm is low. The less intrusive physiological signal measurements, ECG and EMG, are analyzed during this driving task. Statistically significant differences in the features of ECG and sEMG signals were observed between the alert and drowsy states of the drivers during different times of day. In the future, these physiological measures can be fused with vision-based measures for the development of an efficient drowsiness detection system.

Keywords — Driver drowsiness, ECG, EMG, physiological measures, subjective measures