

Artifacts Processing Methods in Heart Rate Variability Signals for Detection of Single Night Sleep Deprivation on Drivers

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Introduction: Sleep deprivation is associated with road accidents. Autonomic nervous system (ANS) activity presents alterations during stress, fatigue and drowsiness episodes that can be estimated from the heart rate variability (HRV) signal, RR interval time series, calculated from the ECG. The artifacts processing of RR series is an important aspect of HRV measurement process.

The aim of this work is to analyze the influence of artifacts processing methods of RR series in the search of useful indexes to detect sleep deprivation on drivers, obtained from several multi-domain representations of the HRV, such as the Poincare graph.

Materials and Methods: Drivers were divided into groups: Non-Deprived (ND, sleep ≥ 4 hours, $N = 13$) and with a single night Deprived (D, sleep < 4 hours, $N = 10$). The ECG signal was obtained on rest for five minutes by a holter, pre-processed and the RR interval series calculated. Eight different methods of editing of artifacts were used. For each resulting RR series, time-domain, frequency-domain and Poincare plot typical indexes were calculated. To analyze differences between the groups for each editing methods Mann-Whitney was used.

Results: For all methods, the indexes of time-domain and frequency-domain resulted with non-significant p values. For each of three methods SD1/SD2, of Poincare plot, resulted p values of 0.01, 0.02 and 0.04 respectively. Fatigue symptoms were not correlated with HRV indexes.

Conclusion: This work shows the importance of processing the RR series to improve the quality of HRV analysis, and also that the Poincare plot analysis of HRV, allows the detection of differences between groups through the SD1/SD2 indexes, not correlating with symptoms of fatigue.

In future works it will be analyzed the influence of the artifacts processing methods in Ultra-Short-Term HRV, through multi-domain analysis, to find parameters capable of sleep deprivation detection.