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IDENTIFICATION OF PSYCHOLOGICAL STRESS
BY ANALYZING ELECTROCARDIOGRAPHIC SIGNAL

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Abstract

It is already demonstrated that mental or psychological stress can affect human health, since it is a major risk factors for numerous current diseases such as: high blood pressure, congestive heart failure, coronary diseases, stroke, causing often sudden death. These diseases are particularly dangerous in the case of car drivers, since they have to make accurate and fast decisions even under stress condition. Frequently, the stress can be detected by different methods with various degrees of accuracy, such as questionnaires, behavior observation or interviews. To detect mental stress, we applied in the present work some techniques to assess parameters useful in identifying stressful episodes: short term heart rate variability (HRV); morphologic variability (MV) of electrocardiographic (ECG) signals. We found some of them as having important discriminative power when the classical mean of heart rates (mHR), mean of RR intervals (mRR), power spectra in Very Low (VLF), Low (LF), and High (HF) frequency ranges, and sympatho-vagal balance index (SVI) are considered. A number of 16 recordings were performed for ECG signals during car driving, involving mental stress state and normal state, included in a multi-parameter data base on physionet.org portal The obtained results shown that mHR, mRR, normalized LF, difference between normalized LF and normalized HF, SVI, mainly computed when using MV approach, were effective metrics for mental stress identification and classification. The identification of stress state and the classification between normal and stress states shown a better accuracy of the analysis based on morphologic variability than that obtained by means of classical HRV technique alone. Moreover, the classification accuracy was raised to values that make our method appropriate for routine stress tests in medicine of labor or economic life.

Key words: classification, heart rate variability, mental stress detection, morphologic variability

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