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Multiple physiological signal-based human stress based identification using non-linear classifiers

Abstract

This paper describes the human stress identification using multiple physiological signals. The Electrocardiogram (ECG), Electromyogram (EMG), Heart Rate Variability (HRV), Galvanic Skin Response (GSR), and Skin Temperature (ST) are the multiple physiological signals acquired and derived from the 40 subjects using mental arithmetic task -based stress-inducing stimuli. To compute the stress induced in the participated subjects, the wavelet denoising, digital elliptic filtering, ectopic beat removal algorithm, Lomb-Scargle (LS) periodogram, Fast Fourier Transform (FFT), and startle detection algorithms are the signal processing methods used to extract the various features of five physiological signals. K Nearest Neighbour (KNN) and Probabilistic Neural Network (PNN) are the nonlinear classifiers used to discriminate the normal and stress states of of the subjects. In order to strengthen the multiple evidence-based stress identification system, we investigated the Higher-Order Statistical (HOS) features in HRV signals that successfully in various applications in cardiac fault detection. Similarly, to evaluate the efficacy of the electromyogram (EMG), galvanic skin response (GSR), and skin temperature (ST), the existing statistical features are considered with a large number of data samples in stress research. The results indicate that the proposed HOS of HRV performed well, with accuracy up to 93.75 %. In other extreme, 76.25 %, 71.25 %, 70.32 %, and 75.32 % were obtained in ECG, EMG, GSR, and ST, respectively. Finally, this study concludes that multiple physiological signal-based subject-independent analyses incorporated and its algorithm gives the reasonably improved detection rate.

Keywords

Human stress; Mental arithmetic task; Multiple physiological signals