Proceeding of The 3rd IEEE Conference on Sustainable Utilization and Development in Engineering and Technology, 2012, pages 77-81

A study on mental arithmetic task based human stress level classification using discrete wavelet transform

Abstract

Several studies examined human stress identification using Mental Arithmetic Task (MAT). The identification and prediction of stress levels using existing data processing methodologies are incompetent to predict the stress levels either in real time or laboratory based experiments. The main objectives of the present work is to classify the stress levels using mental arithmetic task and appropriate signal processing methodology, (ii) to analyze the characteristics of Electrocardiogram (ECG) signal for different stress levels, and (iii) to derive the optimum features from a set of statistical features over different frequency bands. Ten healthy female subjects (20 to 25) years voluntarily participated and ECG signal was acquired. In this work, High Frequency (HF) and Low Frequency (LF) frequency band of ECG signal is directly analyzed similar frequency ranges of Heart Rate Viability (HRV) signals. Discrete Wavelet Transform (DWT) have employed for identifying the stress relevant effect of ANS activity during different stress levels. Statistical features derived using DWT are mapped into four different states including three stress levels (normal, low stress, medium stress, and high stress) using K-Nearest Neighbor (KNN) classifier. Covariance feature gives the maximum mean classification rate of 96.3%, and 75.9% in LF and HF bands, respectively. In addition, the maximum average classification accuracy of 65.5% is achieved using mean feature in LF/HF+LF and HF/HF+LF ratios.

Keywords — ECG, KNN classifier, mental arithmetic task, stress, wavelet transform