Thesis Title: Estimation of User's Psychophysiological Status Using Signal Fusion

Author: Jorge Armando Delgado Muñoz

Program: Biomedical Engineering (Master)

Abstract

This thesis work presents a method for automatic estimation of mental stress levels in different scales based on the fusion of three physiological parameters. Such parameters are measured in an ambulatory way and are directly related to the response of the Autonomic Nervous System. The parameters are cardiac activity, measured through conventional Electrocardiography; Eccrine sudoriferous gland activity, measured through Electrodermal Activity; and Thermoregulation, measured by means of Peripheral body temperature. The signal fusion approach adopted consists of feature extraction from the different parameters from short-term measurements and estimation by means of supervised machine learning models. Different models were trained using a dataset generated from a measurement experiment with a group of volunteers. The accuracy and performance of each trained model is evaluated in order to determine the model that performs the most accurate estimation possible, and the most reliable models are furthermore used to test their performance in a real scenario. The proposed method is conceived to perform automatic detection of the current level of mental stress in home and automotive environments via continuous monitoring.

Keywords: Signal fusion, Machine Learning, Stress, Electrocardiogram, Heart Rate Variability, Electrodermal Activity, Thermoregulation.