ABSTRACT

Stress is a natural human reaction to demands or pressure, usually when perceived as harmful or/and toxic. When stress becomes constantly overwhelmed and prolonged, it increases the risk of mental health and physiological uneasiness. Furthermore, chronic stress raises the likelihood of mental health plagues suchas anxiety, depression, and sleep disorder. Although measuring stress using physiological parameters such as heart rate variability (HRV) is a common approach, how to achieve ultra-high accuracy based on HRV measurements remains as a challenging task. HRV is not equivalent to heart rate. While heart rate is the average value of heart beats per minute, HRV represents the variation of the time interval between successiveheartbeats. The HRV measurements are related to the variance of RR intervals which stand for the time between successive R peaks. In this study, we investigate the role of HRV features as stress detection bio- markers and develop a machine learning-based model for multi-class stress detection. More specifically, a convolution neural network (CNN) based model is developed to detect multi-class stress, namely, no stress,interruption stress, and time pressure stress, based on both time- and frequency-domain features of HRV. Validated through a publicly available dataset, SWELL−KW, the achieved accuracy score of our model has reached 99.9% thus outperforming the existing methods in the literature. In addition, this study demonstratesthe effectiveness of essential HRV features for stress detection using a feature extraction technique, i.e., analysis of variance.

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SYMBOLS AND ABBREVATIONS

1D CNN	:	One-dimensional Convolutional Neural Network
ANOVA	:	Analysis of Variance
ANS	:	Autonomic Nervous System
CSS	:	Cascading Style Sheets
DL	:	Deep Learning
ECG	:	Electrocardiogram
HRV	:	Heart Rate Variability
HTML	:	Hypertext Markup Language
IoMT	:	Internet of Medical Things
KNN	:	K-Nearest Neighbours
ML	:	Machine Learning
MLP	:	Multilayer Perceptron
MySQL	:	My Structured Query Language
RBF	:	Radial Basis Function
SVM	:	Support Vector Machine
SVGA	:	Super Video Graphics Array
WAMP	:	Windows,Apache,MySQL,PHP/Python/Perl