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T1 - A Shrewd Artificial Neural Network-Based Hybrid Model for Pervasive Stress Detection of Students Using Galvanic Skin Response and Electrocardiogram Signals

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N2 - Mental illness issues are a very common health issue in youths and adults across the world. The usage of real-time data analytics in health care has a great potential to improve and enhance the quality of health care services, including diagnosis and medical prescription. Stress is one of the major health issues these days, which leads to many acute and sometimes incurable diseases to the students of very young age. Stress affects physiological parameters of the human body; due to these, human emotions may also change. This research paper proposes a hybrid model for pervasive stress detection, which deals with imbalance class problems using real-time data analytics and Internet of Things and it also presents a new stress analysis system to detect stressful conditions of the student, and to diagnose whether they are stressed or relaxed by using a designed set of experimental tasks. Regular monitoring of students'/professionals' health, including measurement of Galvanic Skin Response (GSR) and Electrocardiogram (ECG) data, provides a good understanding of their stress level. Data are acquired by using GSR and ECG sensors for 34 participants while undertaking five different tasks discussed in the proposed experiment. The graphical relationship between heart rate, blood pressure, and skin conductance across various experimental activities highlights the fact as to how physiological parameters of the human body get affected along with the mental status of the students. This article performs accuracy computation by using different machine-learning models such as Logistic Regression (LR), Support Vector Machine (SVM), K-Nearest Neighbours (KNN), Bagging Classifiers (BAG), Random Forest (RF), Gradient Boosting (GB), and

Artificial Neural Network (ANN) followed by tuning with the best set of hyper parameters for each model. The proposed hybrid classification model deals with the class imbalance problem by using the Synthetic Minority Oversampling Technique. The shrewd ANN-based hybrid model achieves 99.4% accuracy on the self-generated dataset for the mental state classification of the students, which is best among other classifiers such as LR, SVM, KNN, BAG, RF, GB, and ANN. The prediction result of all 34 participants of the experiment is also classified into four categories: relaxed, stressed, partially stressed, and happy.

AB - Mental illness issues are a very common health issue in youths and adults across the world. The usage of real-time data analytics in health care has a great potential to improve and enhance the quality of health care services, including diagnosis and medical prescription. Stress is one of the major health issues these days, which leads to many acute and sometimes incurable diseases to the students of very young age. Stress affects physiological parameters of the human body; due to these, human emotions may also change. This research paper proposes a hybrid model for pervasive stress detection, which deals with imbalance class problems using real-time data analytics and Internet of Things and it also presents a new stress analysis system to detect stressful conditions of the student, and to diagnose whether they are stressed or relaxed by using a designed set of experimental tasks. Regular monitoring of students'/professionals' health, including measurement of Galvanic Skin Response (GSR) and Electrocardiogram (ECG) data, provides a good understanding of their stress level. Data are acquired by using GSR and ECG sensors for 34 participants while undertaking five different tasks discussed in the proposed experiment. The graphical relationship between heart rate, blood pressure, and skin conductance across various experimental activities highlights the fact as to how physiological parameters of the human body get affected along with the mental status of the students. This article performs accuracy computation by using different machine-learning models such as Logistic Regression (LR), Support Vector Machine (SVM), K-Nearest Neighbours (KNN), Bagging Classifiers (BAG), Random Forest (RF), Gradient Boosting (GB), and Artificial Neural Network (ANN) followed by tuning with the best set of hyper parameters for each model. The proposed hybrid classification model deals with the class imbalance problem by using the Synthetic Minority Oversampling Technique. The shrewd ANN-based hybrid model achieves 99.4% accuracy on the self-generated dataset for the mental state classification of the students, which is best among other classifiers such as LR, SVM, KNN, BAG, RF, GB, and ANN. The prediction result of all 34 participants of the experiment is also classified into four categories: relaxed, stressed, partially stressed, and happy.

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