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| **Sr. No** | **Title of Paper** | **Name of the**  **Authors** | **Published**  **Year** | **Remarks** |
| 1 | Stress Detection with Machine Learning and Deep Learning using Multimodal Physiological Data | Pramod Bobade  &  Vani M. | 2020 | Methodology: WESAD dataset (multimodal Dataset) used and different modalities from the dataset were used for feature extraction. This research work has used Python’s sci-kit learn implementation of the aforementioned machine learning classifiers and neural network library Keras for deep learning implementation.  Algorithms: Two types of classification are used three class and binary classification. In binary classification architecture, output has a single node with sigmoid as the activation function. In contrast, output has three nodes with a Softmax activation function in the case of the three-class classification model.  Advantages: This research work has understood the structure and format of the publicly available WESAD dataset, cleaned and transformed data to a set eligible to construct machine learning and deep learning classification methods. WESAD dataset contains data from multiple Physiological modalities like which is not available in other datasets, which makes this work suitable for the detection of stress in human being.  Disadvantages: From Table II (performance of all the classifiers), the DT had the overall worst performance.  Additional points: Six machine learning (Random Forest, Decision Tree, AdaBoost, k-Nearest Neighbour, Linear Discriminant Analysis and Kernel Support Vector Machine) and a deep learning artificial neural network (ANN) were used and their performance was compared.  Results: This model has achieved the accuracy of 84.32% and 95.21% on a three-class and a binary classification problem.  Applications: It is used for stress detection. |
| 2 | A Decision Tree Optimised SVM Model for Stress Detection using Bio-signals | Alana Paul Cruz, Aravind Pradeep, Kavali Riya Sivasankar and Krishnaveni K. S | July 28 –30, 2020 | Methodology: Here, ECG use as the bio signal and extracted its features. For training and validation of that new model they used Physio-net’s “drivedb” database. The evaluation metric used in this study is Accuracy which is calculated using the help of Confusion Matrix.  Algorithms: This model uses Optimised Support Vector Machines (SVM) using decision trees. SVM is a supervised machine learning algorithm which can be used for classification or regression problems. Tree optimised SVM is a combination of Decision Tree and SVM algorithms  Advantages: Here used ECG as the bio signal which is information about respiratory signals - EDR (ECG Derived Respiration) feature can be easily derived without any extra sensors.  Disadvantages: If objective value become high, then it denotes a bad optimised SVM model.  Results: It is able to generate an accuracy of 96.3%. This model is able to do better detection of stress and this model shows improvement in Sensitivity and Elapsed.  Applications: The model with Tree optimised Cubic SVM shows more accuracy in identifying stress and through it we can take remedial measures to reduce health risks. |
| 3 | Automatic Stress Detection Using Wearable Sensors and Machine Learning: A Review | Shruti Gedam  &  Sanchita Paul | July 1-3, 2020 | Methodology: The measures used in this model includes physical measures, physiological signals, answering questionnaire, mathematical test, videos, microblog and other techniques, etc. Physiological signals can be used to detect stress of an individual with the help of wearable sensors and machine learning algorithms. Normally, all the developed system first extracted the features using various algorithms and they applied machine learning algorithms to build classification model. Here, the features extracted using Heart rate, Heart rate variability and skin conductance which are more useful in prediction of stress level of an individual while support the most effective classification algorithms.  Algorithms: Support Vector Machine, Random Forest and K-Nearest Neighbour algorithms most useful for this model.  Advantages: The wearable sensors and machine learning algorithms are effective and affordable for detection of the stress level.  Disadvantages: The limitation is many researchers used multiple features correlated with each other which results in increased computation time and some of them used costly commercial devices for physiological signal collection where low-cost sensors can be used.  Additional points: There are mainly three types of stress which are acute stress (less harmful), episodic acute stress (more harmful than acute stress but less harmful than chronic stress), chronic stress (most harmful). Monitoring and measuring of physiological and physical changes can be used for detecting human stress level through wearable sensors and machine learning.  Results: The best performance achieved in stress detection using ECG system by only utilizing HRV parameters which are extracted from ECG signals was 84.4% classification accuracy by using SVM in a 10-fold approach. They analysed that band-power features from EEG signals and used SVM as classifier which give a three-level of stress recognition system with 75% accuracy and two-level stress system gives 88% and 96% accuracy for the two stressors respectively  Applications: By using wearable sensors (like smart watch), IOT devices, EEG sensor, ECG sensor, videos, other sensor and methods Stress can be detected. |
| 4 | Machine Learning and IoT for Prediction and Detection of Stress | Mr. Purnendu Shekhar Pandey | 2017 | Objective: Internet of Things (IoT) along with Machine Learning (ML) is used to alarm the situation when the person is in real risk. ML is used to predict the condition of the patient and IoT is used to communicate the patience about his/her acute stress condition  Methodology: Remote stress detector is an IOT device which locally collects heart beat reading from a person and sends it to a server on Digital-ocean where they are filtered using a user’s network id to keep track of readings for a particular individual. All the computation is done on the server, which then finally predicts whether the person is stressed or not. This work uses a pulse sensor to detect the pulses from which we calculated the heartbeat rate. Algorithms: Logistic Regression, SVM algorithm, VF – 15, genetic algorithm, Naive Bayes (Bayesian classification algorithm).  Advantages: In future, it can be use in a person’s profile and his daily heart rate measurements along with his galvanic skin response to determine the mood of a person.  Disadvantages: The problem is specifically occurred when dealing with statistical classification, a confusion matrix (error matrix).  Additional points: In this case, Node MCU is used as the development board and micro-python for programming language which runs on an REPL (Read–Eval–Print Loop) interpreter and also use pulse sensor.  Results: Using Logistic Regression and SVM they get an accuracy of 66 % and 68 % respectively.  Applications: This work can used with any health monitoring device and safety device. Through this process we can identify a lot of things, for example whether the person is nervous or not, whether the person is in apprehension or fear, whether the person is working out, whether the person is over trained etc. |
| 5 | Stress detection using deep neural networks | Zhandong Liu | 30 December,2020 | Methodology: Two deep neural networks analysed physiological signals measured from chest-worn and wrist-worn sensors to perform the two tasks of binary stress detection and 3-class emotion classification. The datasets from Schmidt et al. were used for neural network training and testing. The physiological signals were directly input into the neural networks.  Algorithms: LDA, AdaBoost, Random Forest.  Advantages: Deep neural networks are used to carry out accuracy-driven tasks such as classification and identification and it  possess key advantages in their capabilities to model complex systems and utilize automatically learning features through multiple network layers.  Disadvantages: Too many comparisons performed here which is time consuming.  Additional points: They developed a deep 1D convolutional neural network and a deep multilayer perceptron neural network for stress detection and emotion classification. The physiological signals were formatted into vectors and directly fed into the neural networks. Through supervised training, the different layers of the network learned how to represent features. The Softmax function is primarily used in the last layer of a neural network that performs multi-class classification and the sigmoid function which is primarily used in the last layer in a neural network that performs binary classification.  Results: The deep convolutional neural network achieved 99.80% and 99.55% accuracy rates for binary and 3-class classification, respectively. The deep multilayer perceptron neural network achieved 99.65% and 98.38% accuracy rates for binary and 3-class classification, respectively. By analysis the given table we can observe that the deep 1D convolutional neural network, which analysed physiological signals from chest-worn sensors, performed marginally better than the deep multilayer perceptron neural network, which analysed physiological signals from wrist-worn sensors. And both are achieved superior performance over traditional machine learning approach. The neural networks have higher accuracy rates and F1 scores for both binary stress detection and 3-class emotion classification.  Applications: It can be used for stress detection and emotion classification for improving the quality of life and to prevent cancer, cardiovascular disease, depression, and diabetes which is related to stress. |