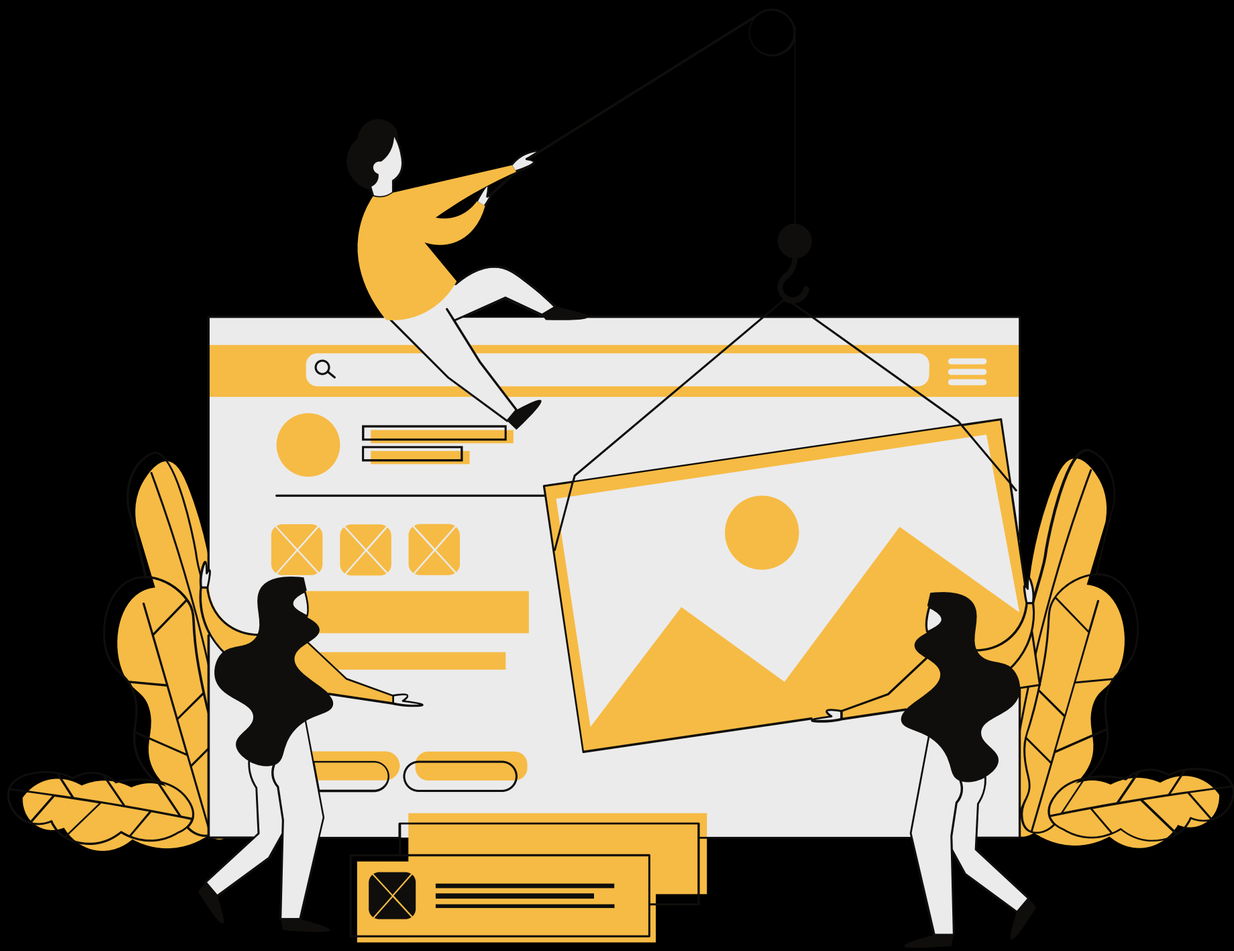
Stress Detection System

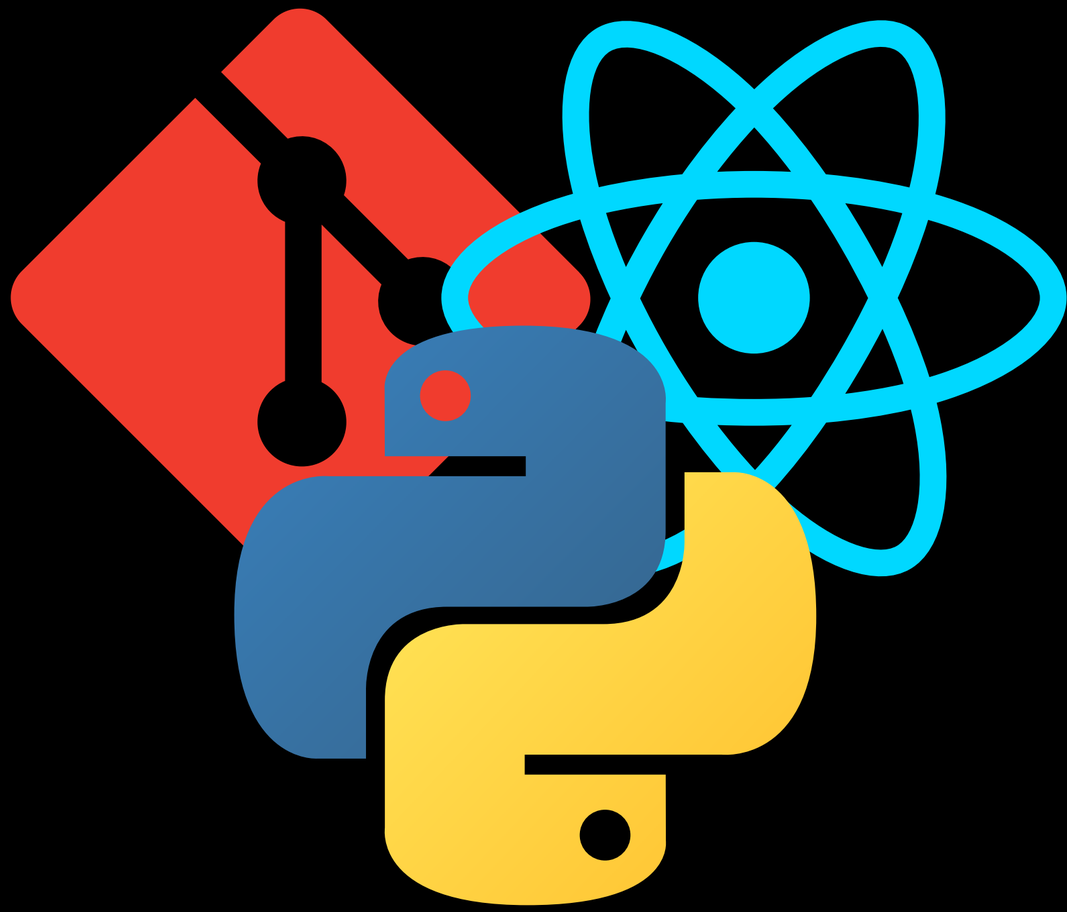


Machine Learning Course Project

TECH STACK USED

ML Model

- Python
- Scikit Learn
- Random Forest Classifier
- WESAD Dataset for wearable stress and affect detection



Application For demonstration:

- React.js
- Flask
- Hosted on AWS

Other Tools:

- Git & GitHub for Version Control and collaboration

Random Forest Algorithm

- A supervised learning technique that can be used for both Classification and Regression problems in ML.
- Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset.
- The greater number of trees in the forest leads to higher accuracy and prevents the problem of overfitting.

Random Forest Algorithm

Why use Random Forest?

- It predicts output with high accuracy, even for the large dataset it runs efficiently.
- It can also maintain accuracy when a large proportion of data is missing.
- It can also give a prediction probability corresponding to each label.

Other Popular Applications of Random Forest

- Banking Sector for Loan Risk,
- Medicine for Disease prediction
- Marketing Trends.

Research Papers

STRESS DETECTION

Psychological and physiological specialists decide stress condition of an individual using questionnaire based stress analysis. This approach carries lot of uncertainty and is unreliable as it depends entirely on the individuals' responses and the people will be timorous to answer the questionnaire.

Solution:

When a person gets stressed, there are notable shifts in various bio-signals like thermal, electrical, impedance, acoustic, optical, etc., by using such bio-signals stress levels can be identified.

ABOUT DATASET (WESAD)

This multimodal dataset features physiological and motion data, recorded from both a wrist- and a chest-worn device, of 15 subjects during a lab study. The following sensor modalities are included: blood volume pulse, electrocardiogram, electrodermal activity, electromyogram, respiration, body temperature, and three- axis acceleration. Moreover, the dataset bridges the gap between previous lab studies on stress and emotions, by containing three different affective states (neutral, stress, amusement).The mean age was 27.5 ± 2.4 years which consisted of male to female in ratio of 4:1

SOME KEYWORDS

ACC An accelerometer is a device that measures the vibration, or acceleration of motion of a structure.

BVP The blood volume pulse is widely used as a method of measuring the heart rate and is embedded in lots of heart rate variability

ECG An electrocardiogram is a simple test that can be used to check your heart's rhythm and electrical activity

EDA Electrodermal activity (EDA) is the property of the human body that causes continuous variation in the electrical characteristics of the skin.

TEMP The temperature of the body which variates due to nervousness according to the state of the body

STUDY PROTOCOL

NEUTRAL

During the baseline the subjects were sitting/standing at a table and neutral reading material (magazines) was provided. The baseline condition aimed at inducing a neutral affective state. A 20 minute baseline was recorded.

AMUSED

During the amusement condition, the subjects watched a set of eleven funny video clips. Each clip was followed by a short neutral sequence of five seconds. In total, the amusement condition had a length of 392 seconds.

STRESS

The subjects were exposed to the well-studied TSST, which consists of a public speaking and a mental arithmetic task. These tasks are known to elicit stress reliably as they inflict a high mental load on the subjects for 10 minutes.

MEDITATION

The amusement and stress conditions, which both aimed at exciting the subjects, were followed by a guided meditation. The aim of this meditation was to ’de-excite’ the subjects

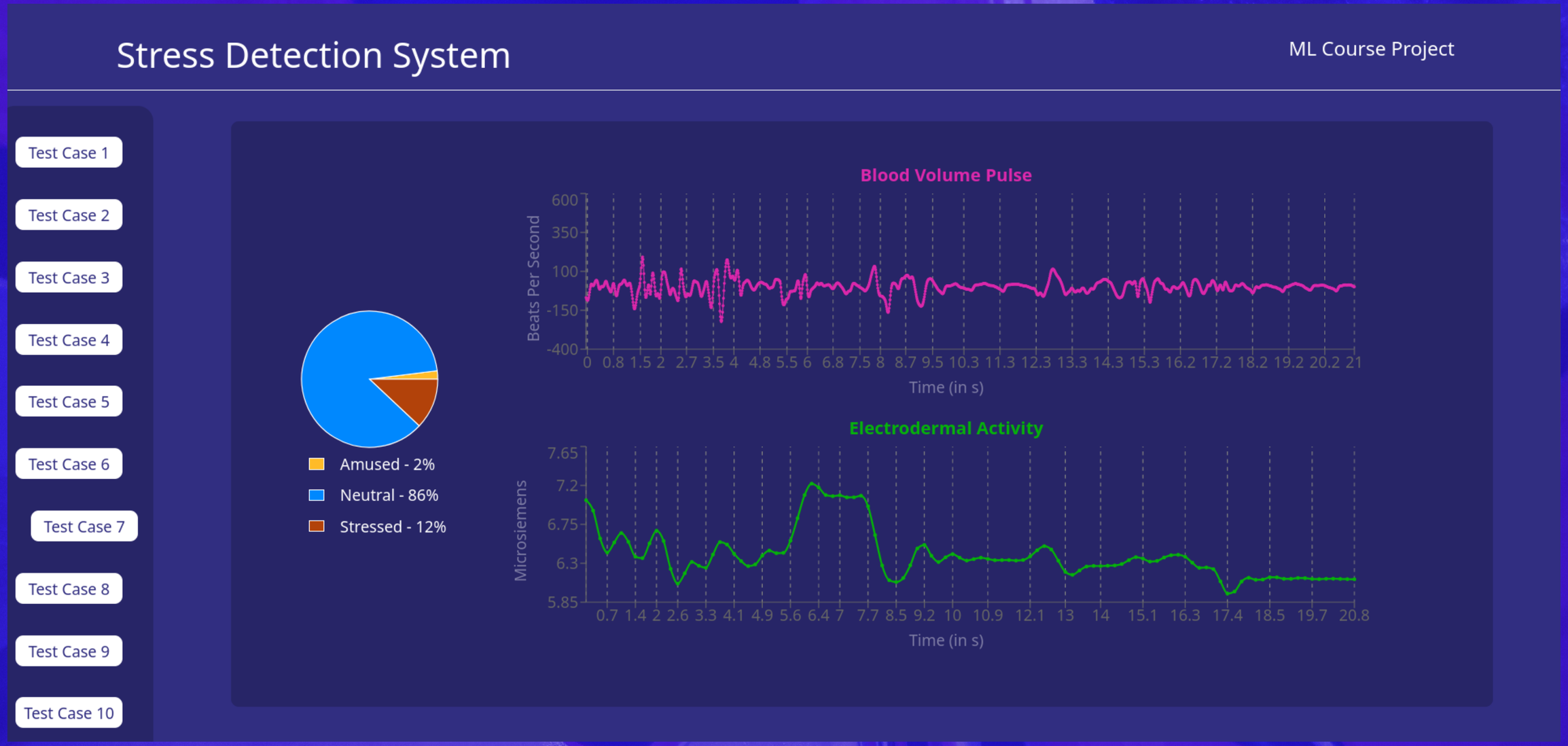
EVALUATION

- In order to validate the study protocol, five self-reports of each participants are collected. Each of the self-reports contained several questionnaires.
- Accuracy is used as evaluation metrics. Accuracy represents the number of correctly classified instances out of all samples.
- Further work can be done by taking self-reports of the subjects from the dataset into account, which were obtained using several organized questionnaires. The modalities such as facial cues, logging information, audio/video recordings, FITBIT data, etc. that are used in various studies separately can be merged with physiological data, and a new dataset can be introduced. Such a dataset can be more precisely used for stress detection as it will contain nearly all the features necessary for stress induction in human beings.

Project Demo

A Demonstration Application is
hosted publically at
http://15.206.150.71/

A few of the raw data taken from the WESAD dataset and how the model predicts stress levels on them

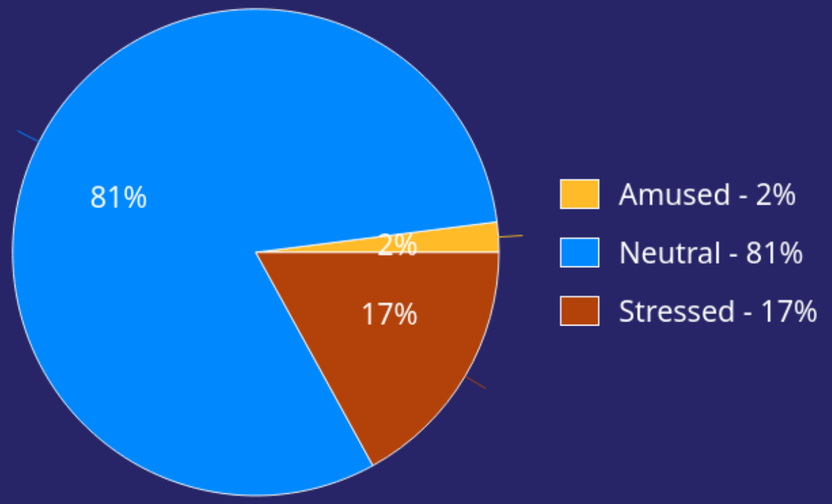


Giving new measurements to predict stress. These measurements can be obtained by any wearable with accurate sensors such as FitBit.

Model Demonstration

BVP_mean: -0.181673262	BVP_std: 107.648359	EDA_phasic_mean: 1.824289
EDA_phasic_min: 0.367977083		EDA_smna_min: 5.22965804e-8
EDA_tonic_mean: 1.23216412	Resp_mean: 0.148183977	TEMP_mean: 35.8170909
TEMP_std: 0.0126739141	TEMP_slope: -0.000169059802	BVP_peak_freq: 0.13566987
age: 27	height: 175	weight: 80

Predict Stress



Team

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GitHub Repo
(give us a if you like our work)

Thank You