**Introduction**

* **Goal**: Automatically providing patients with a prescription and personal assistant for guidance
* **Use Case:**  The doctor can keep an eye on the patient's health without having to communicate with them by implementing an Android program in conjunction with the Wearable Device for monitoring

**Steps Involved in Stress Analysis**

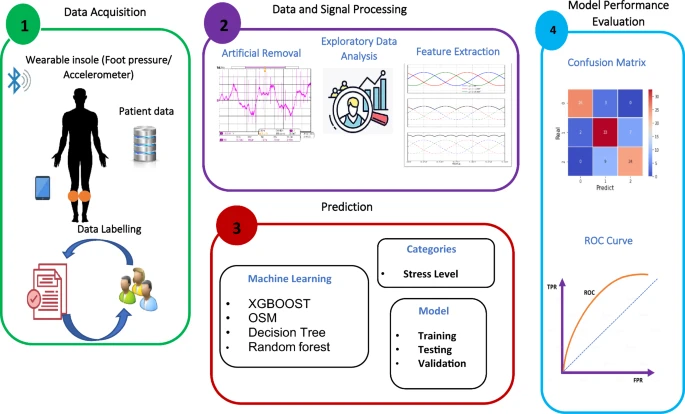
1. **Data Collection**: Data are collected from the wearable sensors, which include physiological signals such as heart rate variability (HRV), skin conductance, and temperature.
2. **Data Processing**: Preprocessing of the data, feature extraction, feature selection, and normalization.
3. **Prediction**:Use machine learning algorithms to predict the stress levels of the individual. The machine learning algorithms used for this phase include decision trees, support vector machines, and artificial neural networks.
4. **Model** **Evaluation**:Performance of the model is evaluated

**Sensors Used**

1. A study proposed a wearable sensor system that combines physiological measurements, such as heart rate variability and skin conductance, with contextual data, such as location and activity level, to detect stress and track its progression
2. Other studies have explored the use of various sensors in stress monitoring, such as electroencephalography (EEG) and electromyography (EMG) sensors. These sensors measure brain activity and muscle tension.

The most commonly used physiological markers of stress are as follows:

* (i) **Galvanic skin response (GSR):** using changes in skin conductivity. During stress, resistance of skin drops due to increased secretion in sweating glands
* (ii) **Electromyogram (EMG):** measuring electrical activity of the muscles. Stress causes differences in the contraction of the muscles which can be used to identify stress.
* (iii) **Skin temperature**: changes in temperature of the skin are related to the stress level.
* (iv) **Electrical activity of the heart:** the most commonly used stress marker parameters derived from the **electrocardiograph (ECG)** are the heart rate (HR) and the **heart rate variability (HRV)**



[Fig. source](https://link.springer.com/article/10.1007/s00521-023-08681-z#Sec7)

Built in Wear OS Sensors Access Repo:

<https://github.com/GeoTecINIT/WearOSSensors>

### **Model Analysis for Mental State Classification**

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| --- | --- | --- |
| **Model** | **Pros** | **Cons** |
| Random forest | Can handle high dimensional datasets with a large number of features  Can handle missing values and categorical variables without requiring preprocessing  Can provide feature importance rankings that can be useful for feature selection  Has low bias and high variance, which can be beneficial for complex problems | May not perform well on small datasets with limited samples  Can be slow and computationally expensive compared to other algorithms  May overfit on noisy datasets |
| XGBoost | Can handle missing values and categorical variables without requiring preprocessing  Has a faster training time and better performance than other boosting algorithms  Can handle imbalanced datasets and produce accurate results with a small number of samples  Provides feature importance rankings that can be useful for feature selection | Can be sensitive to the choice of hyperparameters  May overfit on small datasets with limited samples  Can require more memory compared to other algorithms |
| Decision tree | Easy to understand and interpret  Can handle both categorical and continuous data  Can provide feature importance rankings that can be useful for feature selection  Can handle missing values without requiring preprocessing | Easy to understand and interpret  Can handle both categorical and continuous data  Can provide feature importance rankings that can be useful for feature selection  Can handle missing values without requiring preprocessing |

**Conclusion**: Random Forest Classifier works best on large datasets(most applicable), followed by Decision Trees(Easier Implementation)