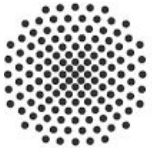

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Exercise 2: Project - Idea pitch
Stress and Affect Detection using WESAD dataset

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Research challenge

- Empathic machines detect the affective state of a human user, adapt their ‘behaviour’ accordingly, and might even exhibit own emotional traits
- Stress - particularly interesting affective state, severe side effects of stress call for automated detection methods
- Using Deep learning (DL), a high performance in Emotion classification based on video/audio is achieved,
    - but DL models are quite demanding in terms of computational resources and are only partially applicable on embedded devices.
    - Also, recording of audio/video data is privacy intrusive. Wearable sensors - minimally intrusive.
- To infer affective states based on multimodal wearable sensor data

Related work

Introducing WESAD, a Multimodal Dataset for Wearable Stress and Affect Detection

- Data collection
  - 17 subjects, dataset contains high resolution physiological (ECG, EDA, EMG, RESP, and TEMP) and motion (ACC) data sampled at 700 Hz from a chest-worn device, and lower resolution data from a wrist-worn device
- Machine learning models applied to the dataset
  - Decision Tree (DT), Random Forest (RF), AdaBoost (AB), Linear Discriminant Analysis (LDA), and k-Nearest Neighbour (kNN)
- Results: Classification accuracies of up to 80 % for three class (neutral vs. stress vs. amusement). In the binary case (stress vs. non-stress), accuracies of up to 93 %. Analysis and comparisons of two device locations (chest vs. wrist)

Philip Schmidt, Attila Reiss, Robert Duerichen, Claus Marberger, Kristof Van Laerhoven, "Introducing WESAD, a multimodal dataset for Wearable Stress and Affect Detection", ICMI 2018, Boulder, USA, 2018

Project idea

- Using the dataset collected in the model, initially cluster the different affective states using Gaussian Mixture Model and also applying other traditional models and Random forests to the below mentioned classification problems
- Distinguish the following:
  - Three different affective states (**neutral, stress, amusement**) - Three class classification
  - Binary case (**stress vs. non-stress**)
  - Two device locations (**chest vs. wrist**) - Evaluate accuracies by using different combinations of modalities

Architecture

- Classical Machine Learning pipeline:
  - Dataset -> Extract features from data -> Training the ML model ->Evaluating the model
- Feature Extraction:
  - Different window sizes are used for segmentation of data such as 5 seconds for ACC signal and 60 seconds for physiological signals such as ECG, EDA and RESP
  - Different statistical features such as the mean **μ** and standard deviation **σ** are computed for raw ACC signals and other physiological signals
- Cluster three different classes using Gaussian Mixture Models and classify
- Evaluation: Accuracy of the three class classification and binary classification

Application scenario

- With monitoring and detecting the stress, we can help diagnosis of stress related problems such as heart disease, obesity and depression
  - According to the British Health and Safety Executive (HSE), stress accounted for 37% of all work-related ill health cases in 2015/16
- Relaxation techniques can be suggested