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Emotion Detection with Machine Learning

10th March 2021

Overview

Emotion detection through bio-signals is the process of analyzing biological changes occurring with emotion changes. Bio-signals include heart rate, temperature, pulse, respiration, perspiration, skin conductivity, electrical impulses in the muscles, and brain activity. For example, a rapidly increasing heart rate indicates a state of stress or anxiety. Such physiological changes or bio-signals help get insight into the psychological state of humans. But the challenge is that a single bio-signal is not enough because it can indicate multiple emotional possibilities. Also, there is noise (artifacts) in the bio-signals that we have to alleviate. One of the increasingly popular bio-signals used to detect inner emotion is electroencephalogram (EEG) which is a test that detects electrical activity in the brain using small, metal electrodes attached to the scalp to detect brain cells communication patterns through electric impulses. Such data can then be fed into a Machine Learning model to discover hidden patters to detect emotions of the subject. Towards that end, different Machine Learning algorithms can be implemented and there are several papers published on that.

Problem

In this research, brain signal data (EEG) is analyzed to detect human affective sates. Since the subjects have specified labels during training time, then this will be a supervised learning problem. Participants are chosen and a subset of one-minute music videos are played for each of them while EEG data is being captured. Then, participants rate their emotions in terms of valence, arousal, like/dislike, dominance, and familiarity using a continuous number ranging from 1 to 9. It is planned to implement at least one of the methods in time series forecasting, CNN, or RNN for this problem. Formerly, I had done an interactive real-time emotion detection project using webcam's streaming data [1], but for this problem the data is the recorded EEG signals of the brain.

Data Set

The data used in this project is driven from either the Muse device [2] or the EEG cap (DEAP dataset) [3]. These collected data can also be Big data, which then are called Machine data. Using these Machine data from such devices in the form of CSV file, implementation of the abovementioned Machine Learning algorithms to find emotion patterns can be done.

References in the Text:

1. Real-time emotion detection: https://github.com/Tina-Gh/Data Analytics/tree/main/Project/Emotion%20Detection
2. Kaggle's Muse dataset: https://www.kaggle.com/birdy654/eeg-brainwave-dataset-feeling-emotions
3. DEAP EEG dataset: https://www.eecs.qmul.ac.uk/mmv/datasets/deap/readme.html