Brain-Computer Interface controlled simulated car in CARLA

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Submitted in partial satisfaction of the requirements for the
Degree of M.Eng
in Embedded Systems for Mechatronics

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31-Movember-2022

Abstract

This is where your abstract will go. Usually this is written last, after writing the entirety of your thesis.

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Summary

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Literature review

Survey_DL_BCI_2020 typical workflow: brain signal collection, signal preprocessing, feature extraction, classification and data analysis signal collection- various method -EEG signals measure the voltage fluctuation resulting from ionic current within the neurons of the brain. Since the ionic current generated within the brain is measured at the scalp, obstacles (e.g., skull) greatly decrease the signal quality—the fidelity of the collected EEG signals, measured as Signal-to-Noise Ratio (SNR), is only approximately 5 percent of that of original brain signals

Preprocessing - denoising and enhancement - signal cleaning(smooting noisy signals or resolving inconsistencies) signal normalization(normalizing each channel of signal along time axis) signal enhancement(removing direct current) signal reduction (reduced representation of the signal)

Feature extraction: extracting discriminating features from the input signals through domain knowledge usually extracted from time-domain, frequency-domain, and time-frequency domain. manual feature extraction - time consuming and difficult.

Classification: users psychological or physical status-for further info analysis.

DeepLearning: 1, For feature extraction. 2, for classification. 3,for both extraction and classification

Why deep learning? Brain waves corrupted by various biological and environmental artifacts. Hence distill inforamtive data from noisy signal. low SNR of non stationary brain signals. Classical machine learning focuses on static data hence cannot classify rapidly changing brain signals accurately.

DNNs can capture both high level features and latent dependencies through deep structures.

Brain Imaging techniques

2004_EEG_ML Study on Machine learning methods with particular focus on feature selection. Dicusses various flaws in validating the machine learning methods and how classification is linked to the task of robust feature selection. BCI commonly uses linear classifiers, but can go wrong if the underlying assumptions are not valid.example: presence of outliers or strong noise. Regularization is a must.

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