
Deep neural networks for analyzing recordings of Brain Computer Interfaces

1 Description

Brain computer interfaces (BCIs) [1, 2] are used to translate electrical signals into commands without the need for motor intervention. They are particularly useful for implementing assistive technologies providing communication and control to people with severe muscular or neural handicaps [3]. More recently BCIs have also found application in other different domains such as gaming [4], virtual reality environments [5], and space applications [6].

BCIs require a decoding component in which brain signals are translated into commands. Usually, classification algorithms are applied to predict the human intention from the analysis of the signals. Several classification algorithms have been used to analyze brain data in the context of BCI applications [7]. They include linear discriminant classifiers (LDA) [8], support vector machines (SVMs) [9], neural networks (NNs) [10], and other classification methods [7].

2 Objectives

The goal of the project is apply deep neural networks for classifying BCI data. In particular, recurrent neural networks are recommended for solving these problems. A set of datasets of an open BCI challenge will be available¹. The student can select any of the 8 datasets for testing the feature engineering method.

The student should: 1) Preprocess the dataset as required. 2) Apply the deep network approach to solve the classification problem. 3) Validate the quality of the classifier.

As in other projects, a report should describe the characteristics of the design, implementation, and results. A Jupyter notebook should include calls to the implemented function that illustrate the way it works.

3 Suggestions

- Read Lotte's paper on classification methods for BCIs <https://hal.inria.fr/inria-00134950/document>.
- See description of the BCI Challenge and datasets [11].
- Implementations can use any Python library that implements DNNs.

References

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¹This dataset, which is described in [11], can be downloaded from http://www.bbci.de/competition/iii/#data_set_i

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