# Removal of EEG Ocular Artifacts

John Smith*

University of California

john@smith.com

**Abstract**

*Here is the abstract.*

## 1 Introduction

The field of Brain-Computer Interfaces (BCI) has in the recent years been under active research, especially with the popularity of machine learning techniques. The reason for the interest, is the many useful application of a well-working BCI, such as replacing lost motor function in disabled people, helping with analysis in brain imaging to diagnose brain conditions or novel applications in computer games.

The general idea of a BCI is to measure brain activity represented by electroencephalogram (EEG) signals, by putting sensors on the scalp, which can measure the electric impulses. However, the EEG data is noisy at best, and this problem can severely affect the classification results in a machine learning algorithm. Therefore, signal processing is an important step in any given BCI.

All in all, this leaves us with several steps in which several techniques may be applied to obtain the corrected EEG signal. Each technique applied may require any number of parameters to be tuned for obtaining the optimal results. Users of the BCI or medical professionals are usually not knowledgeable about tuning such parameters, hence requires either an export to help determine them or extensive training. Another, more useful approach would be to automatically infer the hyper-parameters from the training data. Recent work about algorithmically optimizing machine learning parameters has seen popularity by using Bayesian Optimization, in which the learning process is seen as a black-box function which parameters can be optimized.

### 1.1 Related Work

Much research effort has been put into developing or applying techniques for noise/artifact correction in EEG signals. Well-known methods, such as PCA, ICA or DWT, in the signal processing world has had mixed results.

## 2 Optimization of hyperparameters for Ocular Artifact Correction

short overview, maybe show a figure describing the pipeline.

### 2.1 Ocular Artifact Correction

General intro to oacl. What is the approach.

#### 2.1.1 Artifact Detection

Explain how we detect artifacts and get artifact signals.

#### 2.1.2 Artifact Removal

Explain how we use the artifact signals to remove artifacts from the eeg signal.

### 2.2 Filter-bank CSP

Here we talk about FBSCP, what it is, how it works and why we use it.

*A thank you or further information

### 2.3 Bayesian Optimization

### 2.4 Motor Imagery Classification

## 3 Experimental Results

Here we present how we tested/evaluated the pipeline, which data we evaluated on and the results we got from the our validation efforts.

**Table 1:** *Example table*

| Name | | |
|---|---|---|
| First name | Last Name | Grade |
| John | Doe | 7.5 |
| Richard | Miles | 2 |

$$e = mc^2 \tag{1}$$

### 3.1 Discussion

Here we discuss the results given in section 3, and talk more about what the results imply/how it could be improved.

## 4 Conclusion

Here we conclude on the paper by summarizing what we did and what our results was. Furthermore we address how the problem could be further improved/investigated.

## References

[Figueredo and Wolf, 2009] Figueredo, A. J. and Wolf, P. S. A. (2009). Assortative pairing and life history strategy - a cross-cultural study. *Human Nature*, 20:317–330.