

Preparatory work for the Master Thesis

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Machine learning for analysis of EEG signals in neurosciences.

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What has been done (From 24/03 to 21/04) :

- ▶ Keep reading articles.
- ▶ Data manipulation and try classification on MNIST "MindBigData" dataset.



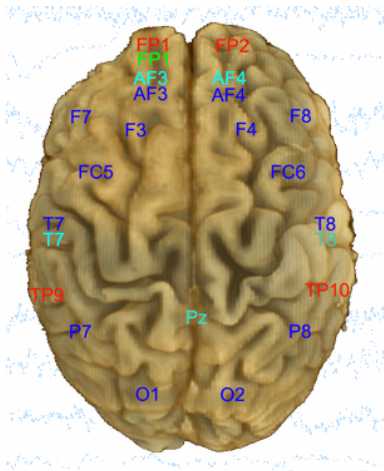
MindBigData,
"MNIST" of the brain.

Link

: <http://www.mindbigdata.com/opendb/index.html>

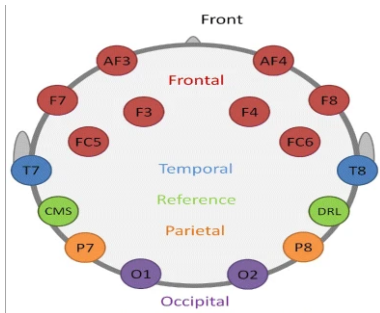
Uses the "Emotiv EPOC"
headset.

Commercial and low-priced.
Covers 14 channels (blue)
following the "10-20" system.



Electrodes placement

The "Emotiv EPOC" headset has 14 channels (2 channels are references).



Electrodes placement on the "Emotiv EPOC" headset [1]



Dataset :

- ▶ MindBigData, "MNIST" of the brain. Link :
<http://www.mindbigdata.com/opendb/index.html>

Largest dataset with the headset "Emotiv EPOC".

Around 90.000 EEG signal samples per digit. (910.000 in total)





Implementation and classification :

- ▶ Lot of time loss with the reading of the dataset.
- ▶ MindBigData, "MNIST" of the brain dataset stored in a "txt" file.
- ▶ Basic classification on subset of the dataset : Only two digits : 0 and 1



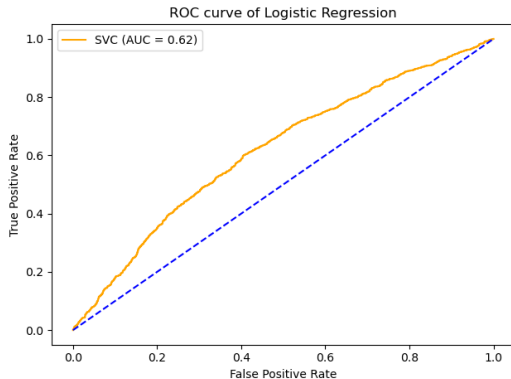
Classification :

- ▶ Logistic regression
- ▶ Support Vector Machine

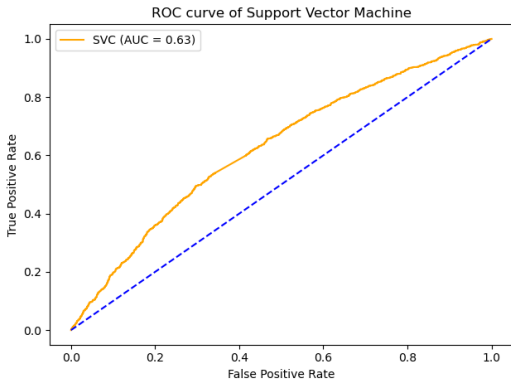
Classifier	Classification Accuracy
Logistic Regression	59.3%
Support Vector Machine	59.6%

Evaluation :

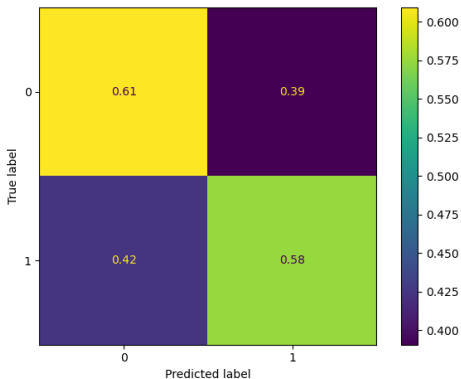
- ▶ ROC curves
- ▶ Confusion matrix



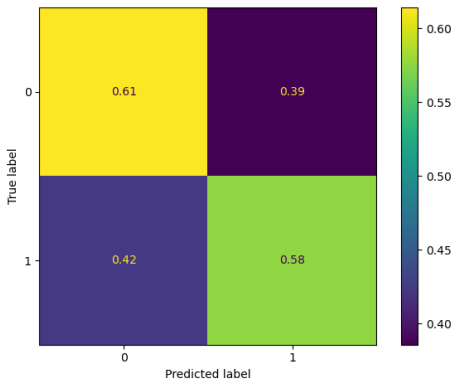
ROC curve for Logistic Regression classification



ROC curve for Support Vector Machine classification



Confusion matrix for Logistic Regression classification



Confusion matrix for Support Vector Machine classification

- ▶ Introduction
 - ▶ Problem description
 - ▶ Objectives / Purpose
- ▶ State of the art
 - ▶ Electroencephalography (EEG)
 - ▶ Ventral Stream / Visual object recognition
 - ▶ Signal path (eye, V1, V2, IT, ...)
 - ▶ Timings
 - ▶ Machine Learning
- ▶ Practical application
 - ▶ Problem and dataset description
 - ▶ Classification
 - ▶ Results
 - ▶ Discussion
- ▶ Conclusion
- ▶ Appendix (if necessary) and Bibliography



- ▶ Keep reading some articles.
- ▶ Writing the report.





- [1] Pradeep Kumar et al. "Envisioned speech recognition using EEG sensors". In: *Personal and Ubiquitous Computing* 22.1 (Feb. 2018), pp. 185–199. ISSN: 1617-4917. DOI: 10.1007/s00779-017-1083-4.

