# CHDR – Research Proposal Capita Selecta

## Research topic

The development of new methods to analyse data from functional brain imaging (EEG with EOG) in the presence of ocular artefacts, using Machine Learning (ML) and pattern recognition, with the goal to automatically and instantly detect, reject and/or correct such artefacts. Methods can be based on:

Machine Learning:

* Artificial Neural Networks (ANN’s, i.e. Autoencoders (Schwenk, 1998), Radial basis function networks (Bishop, 1995), Hopfield networks (Hopfield, 1982), Boltzmann machines (Ackley, Hinton, & Sejnowksi, 1985))
* Supervised/Unsupervised ML (Blind Source Separation (BSS), with Independent Component Analysis (ICA) and Bayesian Classification (Joyce, Gorodnitsky, & Kutas, 2004) (Delorme, Makeig, & Sejnowski, 2007) (Nolan, Whelan, & Reilly, 2010) **(LeVan, Urrestarazu, & Gotman, 2006)ⁱ**)

And/or based on standard industry protocols for removing EOG artefacts (BSS, Least Mean Squares (LMS), (Klados, Papadelis, Lithari, & Bamidis, 2008) (Sadasivan & Dutt, 1996) (Avalos, Sanchez, & Velazquiez, 2014) (Beng Gan, Zahedi, & Alauddin, 2011)).

**ⁱ** Start with Bayesian learning: develop classifier to automatically detect epochs with artefacts.

## Objective

Develop automatic and efficient method that can be applied in real time. Prefer correction over rejection of epochs. End product is a working (prototype) filter implemented in Python and a report that includes extensive literature reviewing and method recommendations.

## Methods

Literature review, develop Python scripts, testing on available data.

# References

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