Detecting drug-related signatures in EEG data using Model-directed Canonical Correlation Analysis

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There is currently considerable interest in detecting whether drugs cross the blood/brain interface, especially for pain relief. However it is not possible to directly assay the levels of a drug in the brain, so indirect methods are needed. One of these is the electroencephalogram (EEG), which provides a non-invasive method of detecting brain activity. Typically time slices of the EEG signal are subject to a Fourier Transform which gives a periodogram of the signal versus frequency at a sequence of time points.

We have developed an algorithm which detects a frequency "signature" in these periodograms which is correlated with the imputed dose level of a drug in the brain. The approach uses Canonical Correlation Analysis to detect the signature which maximises the correlation between the EEG periodogram and the imputed dose obtained from a PK model with unknown non-linear parameters, where the unknown nonlinear parameters of the PK model are estimated by maximising the Canonical Correlation. We have called this technique Model Directed Canonical Correlation Analysis (MDCCA). We will present the algorithm and illustrate it with experimental EEG data from rats.