

Space-Time Independent Component Analysis applied to epileptic EEG

Supervisor: Prof. Christopher James, Warwick Engineering in Biomedicine, School of Engineering. (C.James@warwick.ac.uk)

Epilepsy is one of the major brain disorders with almost 1% of the population being affected by this debilitating disorder. The electroencephalogram (EEG) is a recording of the electrical activity of the brain recorded from the surface of the scalp. The EEG is one of the major diagnostic tools used to detect the presence/ absence of epileptiform activity and requires diligent manual analysis by a trained neurophysiologist. Automated analysis techniques are used to automatically detect the presence/absence of epileptiform activity in multi-channel recordings of EEG during and in-between epileptic seizure activity.

Independent Component Analysis (ICA) is a powerful analysis technique that through the assumption of statistical Independence of sources manages to perform a blind source separation (BSS) of numerous sources underlying multichannel recordings of mixed sources. ICA has enjoyed much success applied to the EEG in order to perform artifact reduction and to identify possible underlying sources. When applied to multichannel EEG recordings, standard or “ensemble” ICA essentially performs a BSS action creating a set of spatial filters. Equally, through the use of a technique involving dynamical embedding, ICA can be applied to single-channel recordings, effectively performing a BSS identifying a set of “spectral” filters (Finite-Impulse Response filters). Recently a technique involving the combination of both spatial and temporal information in ICA has been investigated – space-time ICA (ST-ICA) – and has shown promise in being a very powerful technique to extract multiple underlying sources of interest.

This project concerns the further development of the ST-ICA method as applied to pre-recorded epileptiform EEG recordings, and specifically deals with the non-trivial issue of *automated, objective* source identification in the BSS separation process. A data-set of epileptiform multichannel EEG recordings are available to assess the performance of the method being developed.

Further information on this project can be obtained on request from: C.James@warwick.ac.uk