**CNV connectivity analysis**

This repository contains the programs for the connectivity analysis of patient data with frontal lobe lesions. We did the analyses on three groups; controls, patients with lateral frontal lesions and patients with orbitofrontal lesions.

The purpose of the analysis is to investigate connectivity during the preparation interval of our CNV data. We want to look at whether connectivity is different in the Go versus Nogo conditions and whether connectivity during motor preparation is altered by lesions to frontal subregions.

We therefore do the connectivity analysis on the 500 ms before the imperative stimulus.

The preprocessing was done using functions from EEGLAB and custom made functions from EEGLAB.

The preprocessing consisted of

1. Filtering (DC\_offset\_removal), zero phase filter to remove the DC, see here (<https://sites.google.com/site/marialstavrinou/home/dc-offset-removal-filter-in-matlab>)
2. Interpolation of bad channels (eeglabInterpolate.m)
3. Run ICA to remove eye blinks and eye movement components.
4. We did not rereference (during recording the reference was CZ), but consider using Laplacian.

The clean and preprocessed datasets were then put into the connectivity analysis.

The connectivity analysis on the EEG datasets was done with the Directed transfer Function (DTF) method. Especially a modified version of the original DTF algorithm was made that calculates the connectivity in short time intervals (see Ding et al. 2001). These modifications were made by Maria Stavrinou on functions of the e-connectome software. (<http://econnectome.umn.edu/>). The DTF algorithm is based on a multivariate autoregressive algorithm that needs a correct model order to represent the data. For that for every single subject, an individually chosen model order was calculated, refrained in the interval 1-20, and calculated using the arfit toolbox ([https://www.mathworks.com/matlabcentral/fileexchange/174-arfit](https://www.mathworks.com/matlabcentral/fileexchange/174-arfit" \t "_blank)) [Schneider and Neumaier, 2001; Numaier and Schneider, 2001].

The analysis was run on a subset of 29 single electrodes. First the connectivity between them was calculated. Then the connectivity between preselected areas, each consisting of 3 electrodes, each was calculated (We are considering only using connectivity from single electrodes – the same electrodes we have used for the pre-selected areas).

The selection of electrodes was done taking care to have enough good channels in all subjects.

The selected electrodes and electrode groups for the analysis are:

* Frontal left (FL) : FL1,FL3,FL5
* Frontal Right(FR): FR2,FR6,FR4
* Central Left (CL): CL3,CL1,CL5
* Central Right (CR): CR2,CR6,CR4
* Parietal Left (PL): PL1,PL3,PL5
* Parietal Right (PR): PR1,PR3,PR5

See figure below (we chose not to use the midline groups)



There is a program that has as output excel files with values of connectivity, that are to be used for the statistical analysis.