EEGLAB AD plug-in tutorial

What is the AD plug-in for EEGLAB?

The AD plug-in is a set of Matlab tools developed by the IDA group of the TU of Berlin, that allows the decomposition of the EEG data using the SSD, SPoC and cSPoC methods. These tools are designed to work within the EEGLAB environment, providing a GUI to decompose the data into different relevant components:

1. SSD - Extracts components with optimized signal-to-noise ratio at a frequency band of interest.
2. SPoC - Extracts components with maximal power covariance with the univariate target function z.
3. cSPoC - Extracts components with maximal envelope correlations from N oscillatory and multivariate datasets. For N>2, the extracted components maximize the pairwise averaged envelope correlations.

All of the tools can also be used from the Matlab command line, providing expert users with the ability to use them in custom scripts.

Requirements

In addition to the requirements of EEGLAB, AD plug-in requires the following folders to be stored in the plug-in folder: SSD ; SPoC ; cSPoC ; utils. This folders are found in the following repository:

https://github.com/svendaehne/matlab_SPoC

Download and Installation

1. Download the compressed AD plug-in file ad.zip into the 'plugins' directory of your EEGLAB distribution.
2. Uncompress the downloaded file using utility software. Inside your 'plugins' directory, you should now have a directory called 'AD' containing necessary m-file and folders.

3. Obtain the following folders from the SPoC repository (https://github.com/sven-daehne/matlab_SPoC) and store them in the 'AD' directory: SSD, SPoC, cSPoC, utils.

Starting EEGLAB should now automatically recognize and add the plug-in. You should see the following line appear in your Matlab environment window:

EEGLAB: adding "AD" v.1.0 (see >> help eegplugin_AD)

Voilà!

Tutorial

Using components

After running each of these decompositions your data will be assigned with components (saved in the ICA components slot).

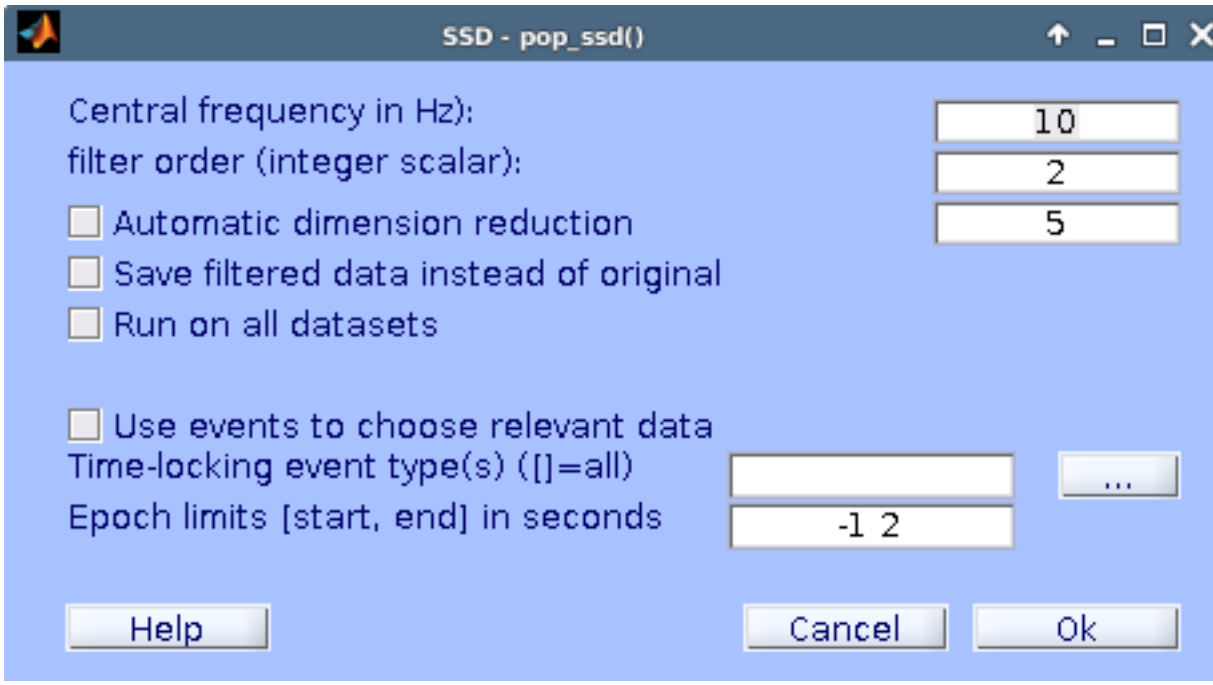
Read the ICA tutorial (http://sccn.ucsd.edu/wiki/Chapter_09:_Decomposing_Data_Using_ICA) to learn about the following actions which can be performed using AD components, in the exact same manner:

1. Plotting scalp maps (http://sccn ... #Plotting_2-D_Component_Scalp_Maps)
2. Plotting components activation (http://sccn ... #Scrolling_through_component_activations)
3. Studying and removing components (http://sccn ... #Studying_and_removing_ICA_components)

SSD

Run

1. Run EEGLAB and load the relevant dataset/s. Data can be either continuous or epochs EEG.
2. Select Tools > Advanced Decomposition > Run SSD. This calls the function pop_ssd.m.



3. Fill out the parameters form and press OK. From left to right:

   (a) Central frequency for the filtering processes.

   (b) Filter order used for butterworth bandpass and bandstop filtering. If unsure about it, use the default value of order 2.

   (c) Automatically subtract components from data (Yes/No).

   (d) Only relevant if you marked the checked box in (c) - numbers of component to keep (the rest will be subtracted).

   (e) Overwrite the original data with the data filtered around the central frequency given at (a) (Yes/No).

   (f) Run the same calculation on all loaded datasets (Yes/No).

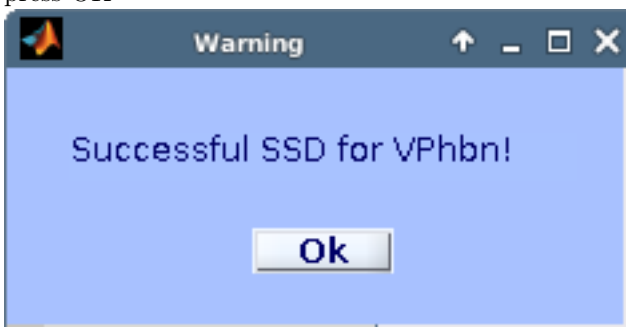
   In case the data is continues and contains event marks, you could also choose to use only event related data, using these parameters:

   (a) Mark to use this option.

   (b) The name of the event/s you wish to use.

   (c) The limits around the events. Data outside these limits will not be taken into account for the calculation.

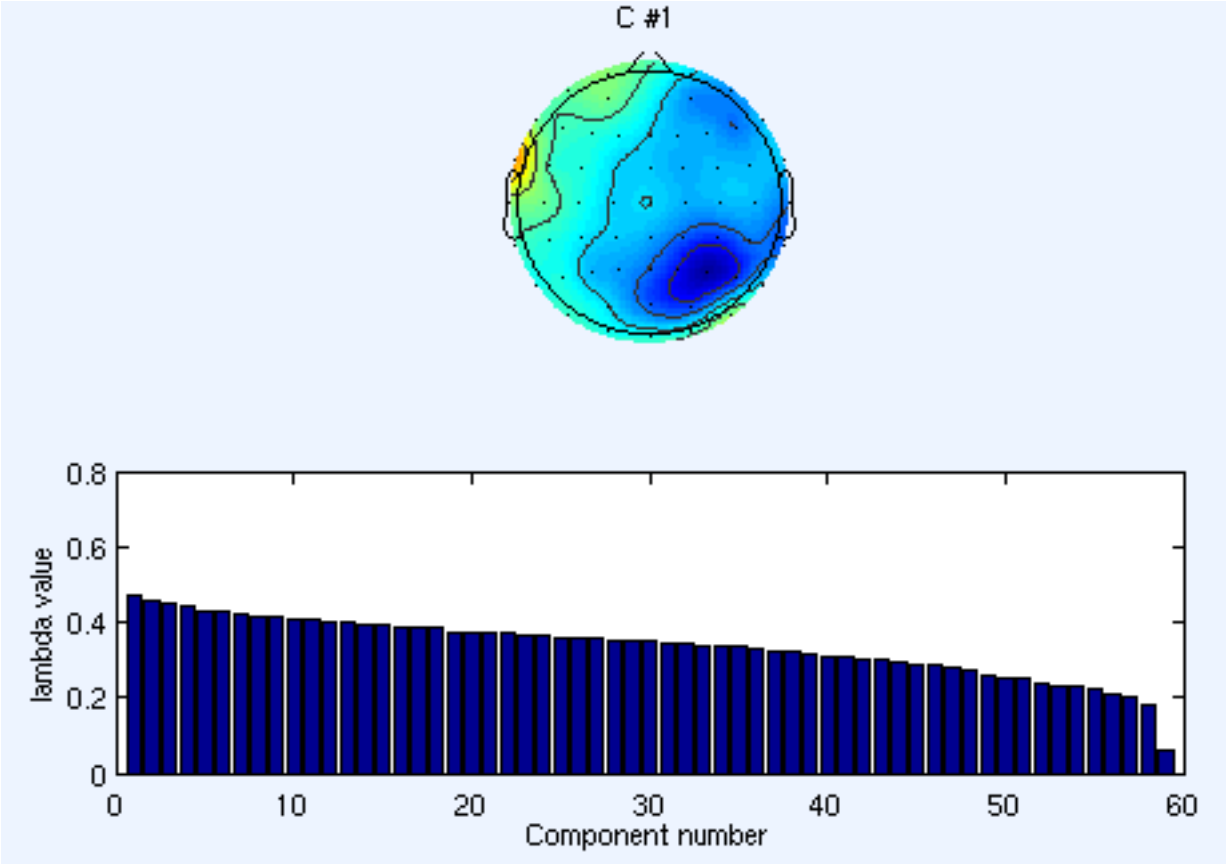
4. Wait until the following massage (With your dataset name) appears and press OK



The components are now stored under EEG.icaweights. old weights, from pervious decompositions are stored under EEG.etc.oldweights.

plot

For SSD and SPoC you can plot the lambda values of the decomposition. Select Plot > Advanced Decomposition > Lambda spectrum.

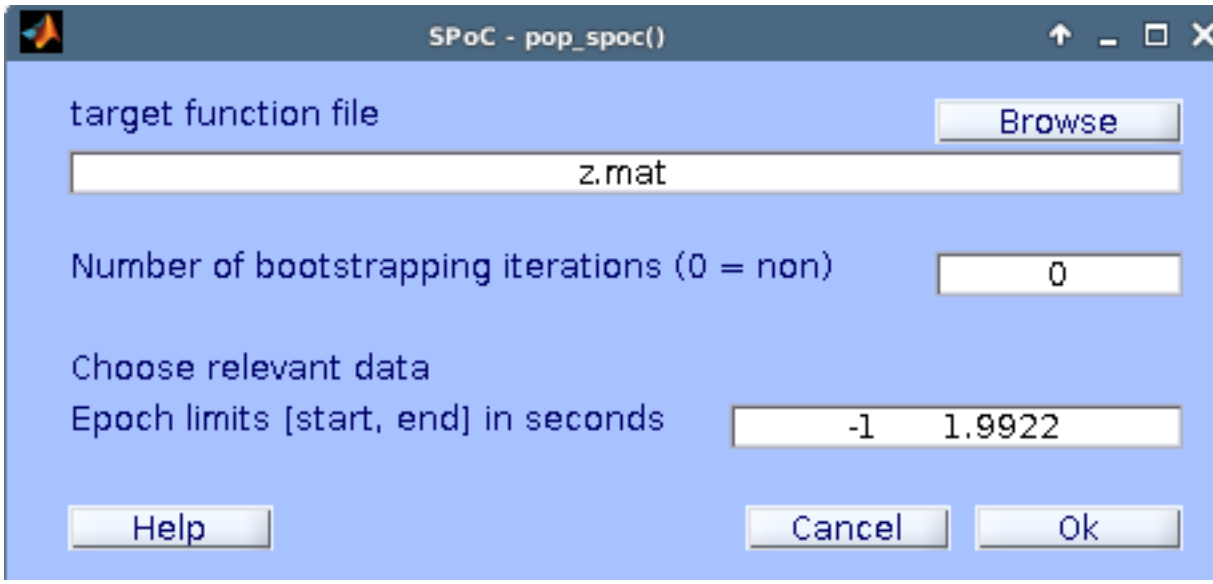


clicking on a blue bar shows the scalp plot of the relevant component.

SPoC

run

1. Save the relevant z function as a variable in a .mat file <<expand on this>>.
2. Run EEGLAB and load the relevant dataset. Data can be either continuous or epochs EEG.
3. Select Tools > Advanced Decomposition > Run SPoC. This calls the function pop_spoc.m.



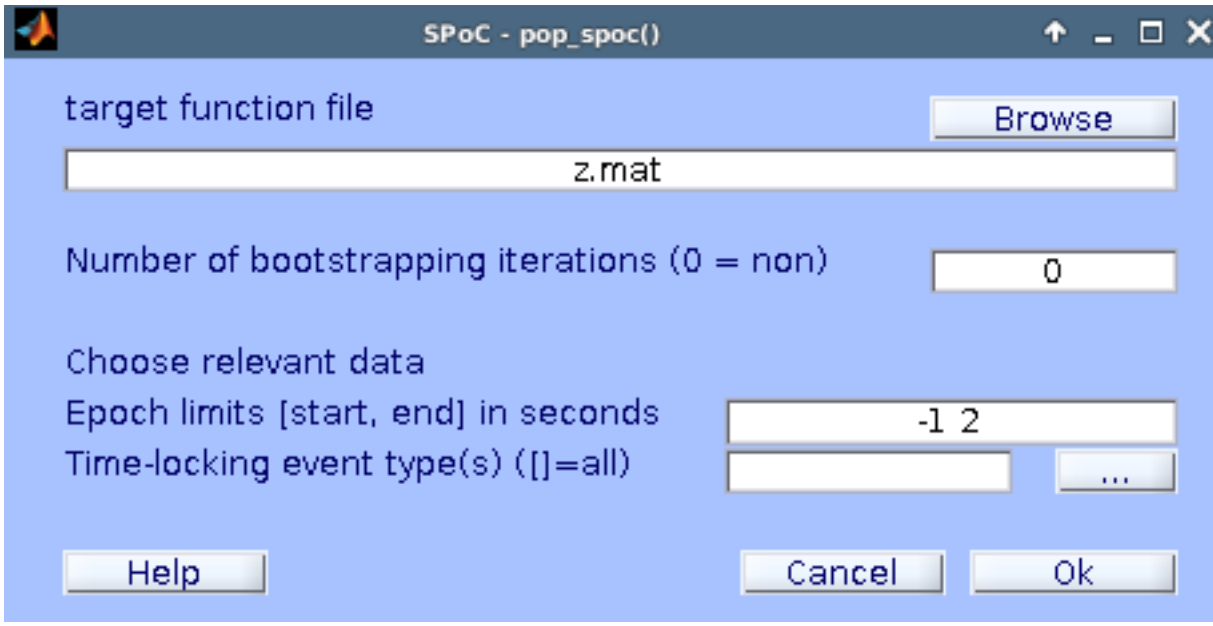
4. Fill out the parameters form and press OK. From left to right:

   (a) Target function file path. You could use the browse option to find the file in your folders.

   (b) Number of bootstrapping iterations used to calculate p-values for for the results.

   (c) The relevant data limits for the calculation. Data outside these limits will not be taken into account.

   In case the data is continues, you could still use SPoC using event marks, using these parameters:



(a) The limits around the events. Data outside these limits will not be taken into account for the calculation.

(b) The name of the event/s you wish to use.

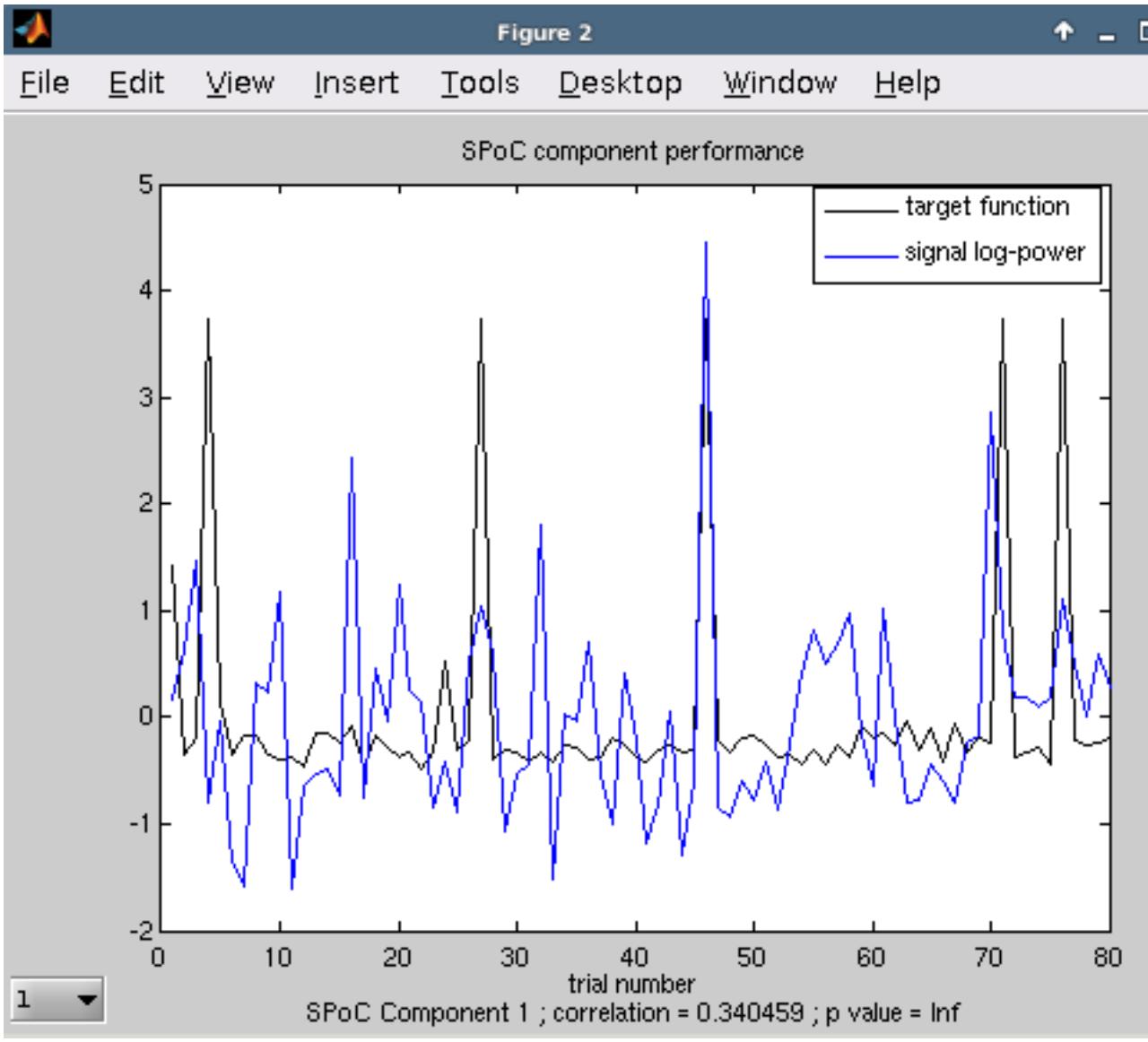
5. Wait until the following massage (With your dataset name) appears and press OK

The components are now stored under EEG.icaweights. old weights, from pervious decompositions are stored under EEG.etc.oldweights.

plot

See the plot section of SSD for lambda spectrum plot.

Select Plot > Advanced Decomposition > SPoC results.



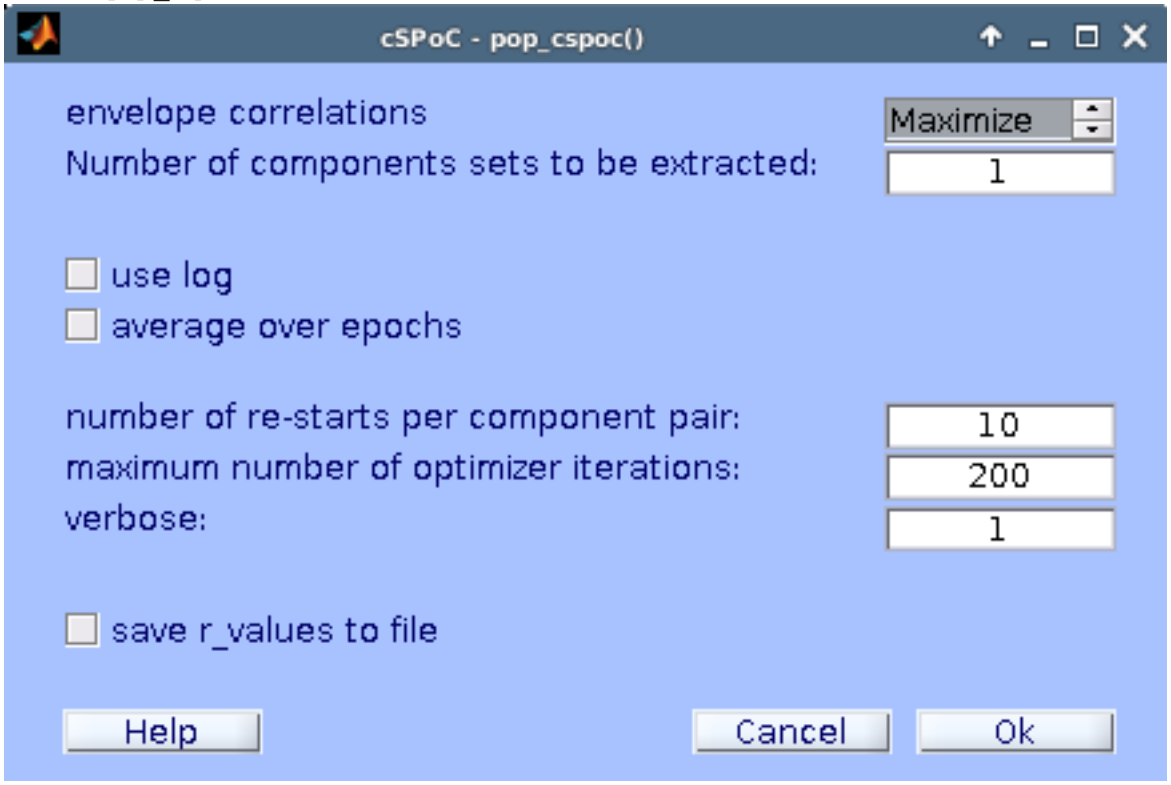
Choose any component from the drop list to show its power function next to the target function.

cSPoC

run

1. Run EEGLAB and load all the relevant datasets. Any loaded dataset will be taken into account. Data has to be epoched.

2. Select Tools > Advanced Decomposition > Run cSPoC. This calls the function pop_cspoc.m.



3. Fill out the parameters form and press OK. From left to right:
   (a) Maximizing or minimizing the envelopes correlation.
   (b) Number of envelope-correlated components per dataset to be extracted.
   (c) Optimize correlations of log-envelopes rather then envelopes (Yes/No).
   (d) When optimizing the correlations, average the source envelopes within epochs (Yes/No).
   (e) Number of re-starts per component pair.
   (f) maximum number of optimizer iterations.
   (g) Level of detail in progress feedback.
   (h) Save result correlation to .mat file (Yes/No).
4. Wait until the following massage appears and press OK

The components are now stored under EEG.icaweights. old weights, from pervious decompositions are stored under EEG.etc.oldweights.

plot

Select Plot > Advanced Decomposition > cSPoC results.

Typical workflow

Reference