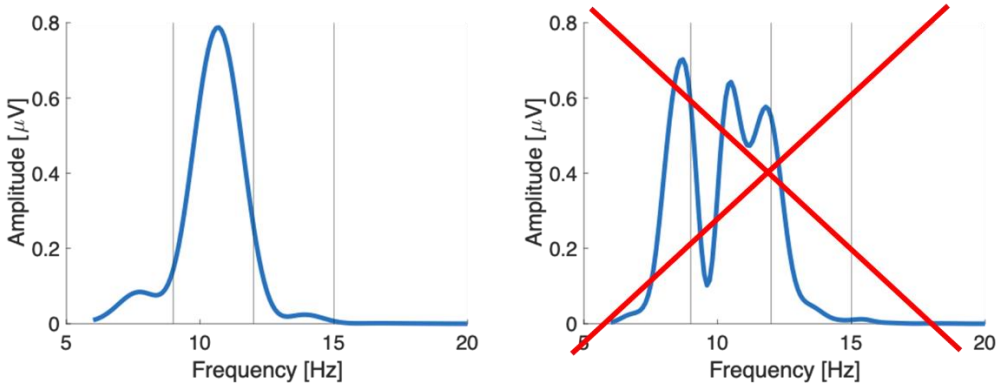
Project 1

Analysis of EEG sleep spindles in COVID-19 survivors

Estimate the averaged slow and fast spindles and localize them in the inverse domain (with Brainstorm) from a high-density EEG recording acquired during a nap in: i. one participant discharged from an intensive care unit (ICU - 023) due to COVID-19 infection between March and May 2020 and ii. one participant never been infected by the virus (CTRL - 033).

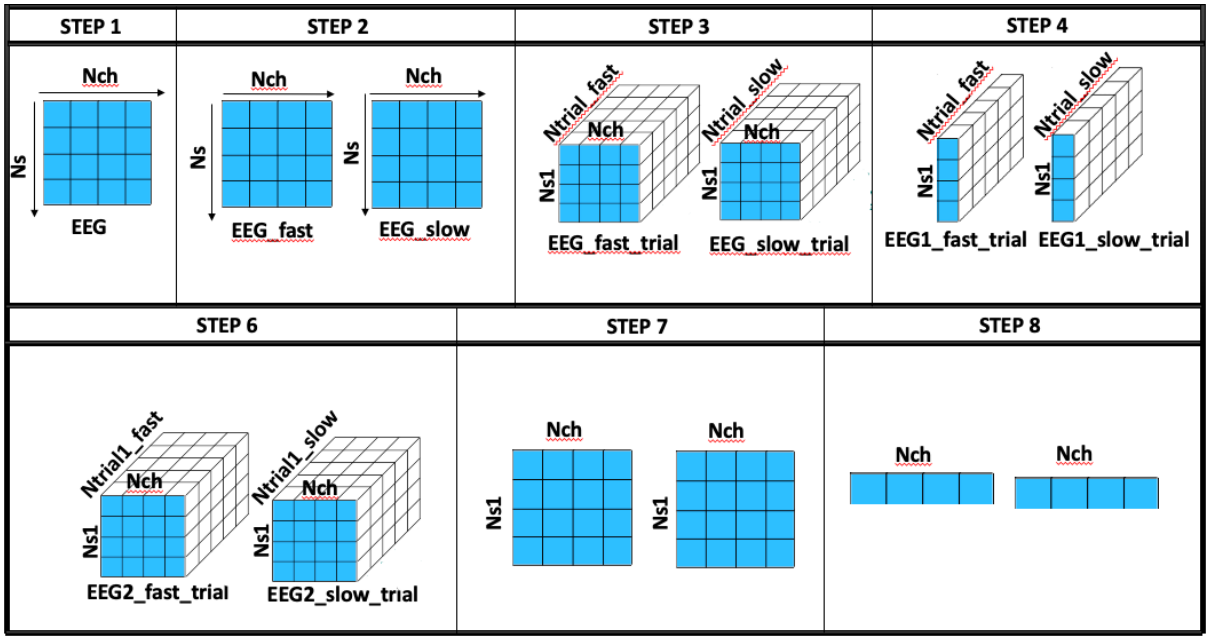
Hints:

1. Load the data CTRL033_nap.mat and ICU023_nap.mat (204 EEG channels). The sampling rate is 250 Hz.
2. Filter the data in the [9-12] Hz and [12-16] Hz frequency ranges. Save in two arrays respectively the slow and fast tracks.
3. Identify the spindles: fix the duration of each spindle at 500 ms and use the time instants contained in spindles_timing_033.mat and spindles_timing_023.mat as starting points. Save in two 3-d matrices the signals.
4. Compute the average between all the EEG channels for every spindle.
5. Compute the spectrum of each signal obtained in point 4. (check pwelch.m function [pxx,f] = pwelch(X1,L,0.6:0.1:20,fs) with X1=data, L=the length of data, [0.6:0.1:20]=frequency range, fs=sampling frequency).
6. Plot all the spectra and discard the spindles (trial) with the maximum peak frequency out of range ([9-12] Hz for slow and [12-16] Hz for fast) (see the example below for slow spindle).



7. Average the remaining trials considering all the channels and plot the results.
8. Average the results obtained at point 7. over time and plot the topographies (eeglab function topoplot).
9. Starting from the signal obtained at point 7. localize the activity at 0 ms in the inverse space, using Brainstorm.

See the figure below to check the dimension of the matrices obtained at each point.



Data availability:

https://drive.google.com/drive/folders/1t0kmrh_W7CI5zuTup-H1F2yx1g7dt-E5?usp=share_link