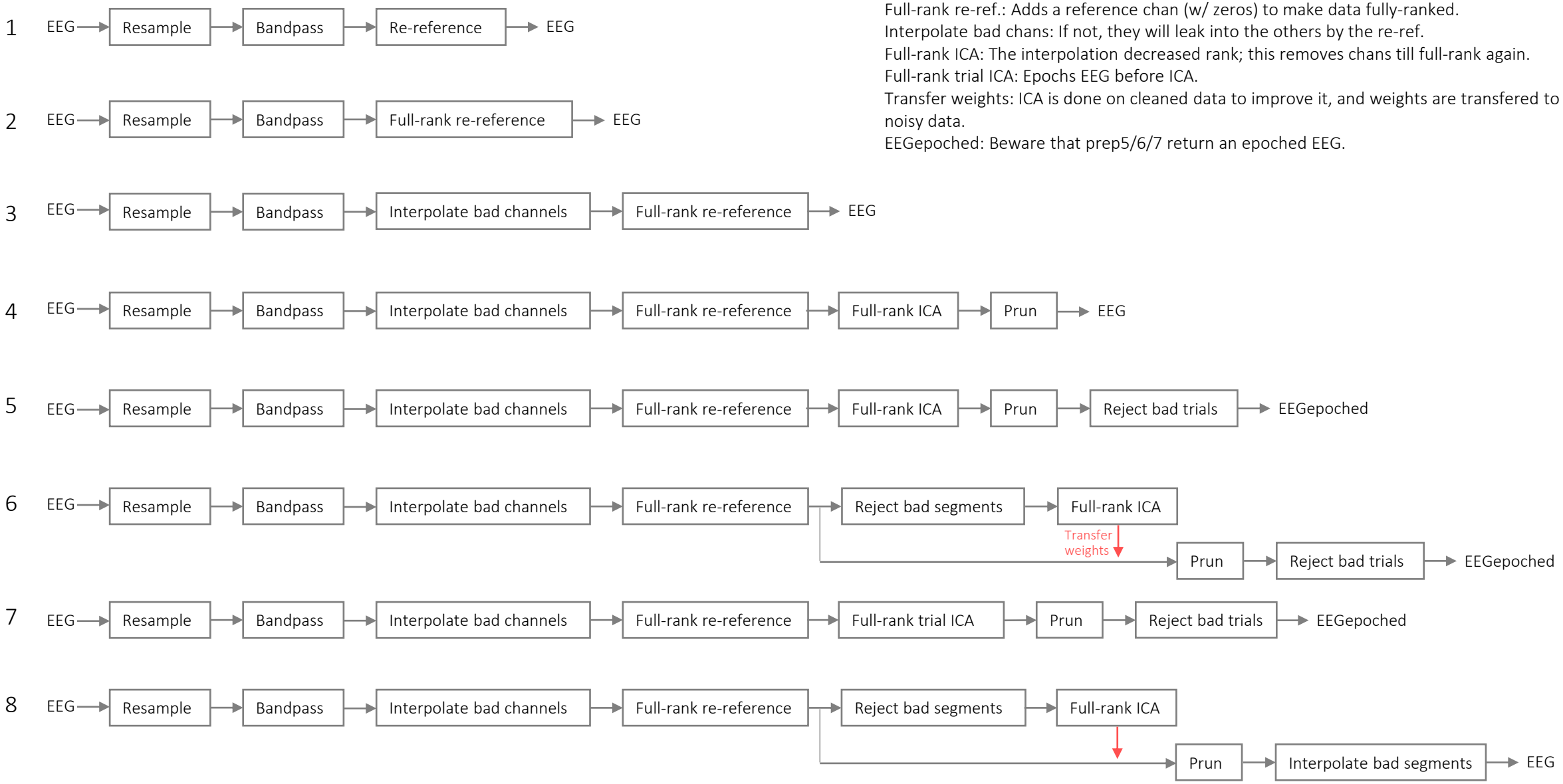
Preprocessings

A tutorial

What they do



References

https://sccn.ucsd.edu/wiki/Makoto's_preprocessing_pipeline

Full-rank re-ref.: Adds a reference chan (w/ zeros) to make data fully-ranked.
Interpolate bad chans: If not, they will leak into the others by the re-ref.
Full-rank ICA: The interpolation decreased rank; this removes chans till full-rank again.
Full-rank trial ICA: Epochs EEG before ICA.
Transfer weights: ICA is done on cleaned data to improve it, and weights are transfered to noisy data.
EEGepoched: Beware that prep5/6/7 return an epoched EEG.

What they do


Rest1 EEG
Resample
Bandpass
Interpolate bad channels
Full-rank re-reference
Full-rank ICA
Prun
Interpolate bad segments
EEG

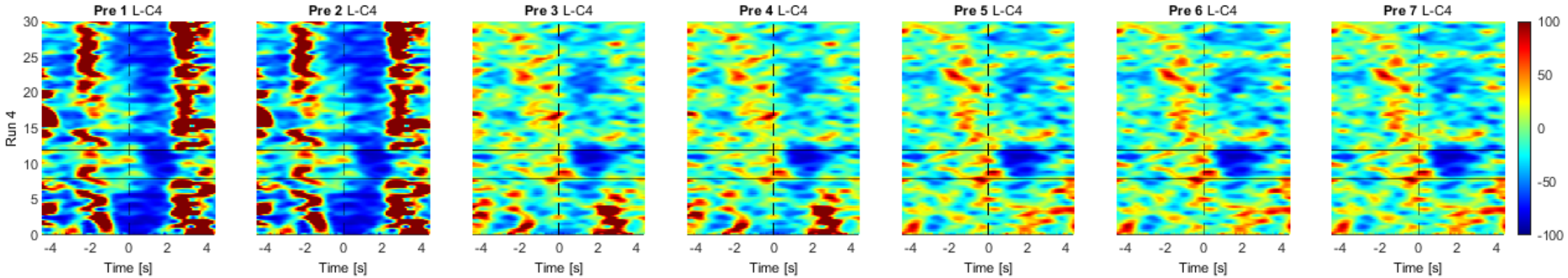
How to use them

```
% Download them from: https://github.com/LaSEEB/NeurAugVR/tree/master/preprocessings
% Install EEGLAB plug-in in the GUI: fullRankAveRef
% Load EEGLAB without the annoying window and variables:
addpath('…/eeglab2021.0')
varsbefore = who; eeglab; varsnew = []; varsnew = setdiff(who, varsbefore); clear(varsnew{:})

load('EEG.mat', 'EEG');
resamp = 250;  % resample rate
hp = 1;  % highpass
lp = 40;  % lowpass
dirs = {'S  7', 'S  8'};  % trial event names
elims = [-5, 5];  % trial limits [s]
ereject = true;  % If true, bad trials get rejected, if false, just marked
no_interp_chans = {'C3', 'C4'};   % Do not interpolate C3 and C4 even if bad
no_discard_chans = {'C3', 'C4'}; % Do not discard C3 and C4 to make data fully-ranked to ICA

EEGs{1} = prep1(EEG,resamp,hp,lp);
EEGs{2} = prep2(EEG,resamp,hp,lp);
EEGs{3} = prep3(EEG,resamp,hp,lp,no_interp_chans);
EEGs{4} = prep4(EEG,resamp,hp,lp,no_interp_chans,no_discard_chans);
EEGs{5} = prep5(EEG,resamp,hp,lp,dirs,elims,ereject,no_interp_chans,no_discard_chans);
EEGs{6} = prep6(EEG,resamp,hp,lp,dirs,elims,ereject,no_interp_chans,no_discard_chans);
EEGs{7} = prep7(EEG,resamp,hp,lp,dirs,elims,ereject,no_interp_chans,no_discard_chans);
EEGs{8} = prep8(EEG,resamp,hp,lp,no_interp_chans,no_discard_chans);

no_interp_chans = {};
no_discard_chans = 'all';
EEGs{9} = prepRest1(EEG,resamp,hp,lp,no_interp_chans,no_discard_chans);

for i = 1:numel(EEGs)
   figure
   prep_report(EEGs{i})
   title(sprintf('Pre %d',i))
end
```

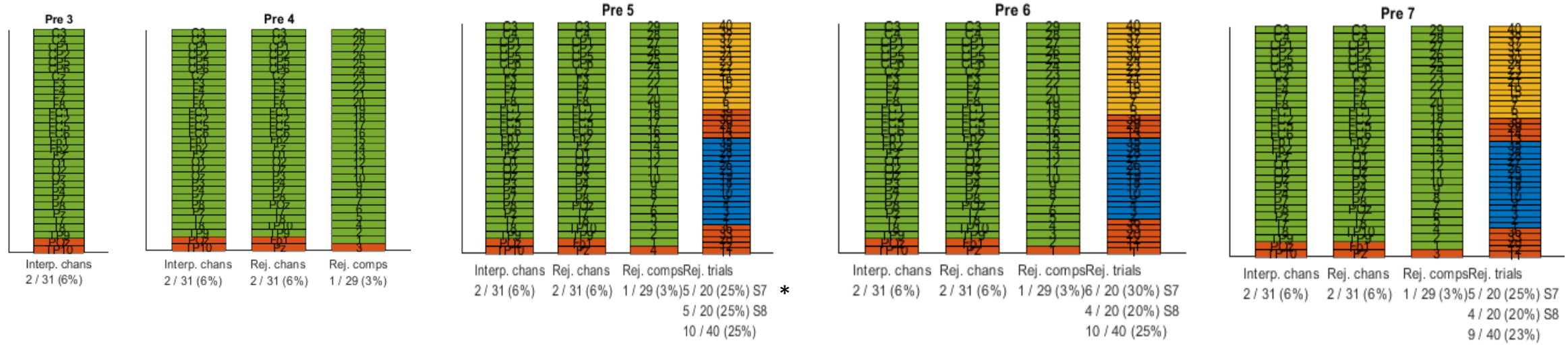
Example of their results

From Pre 3 onwards, bad chans are interpolated, so they don't contaminate other channels in the re-ref, in this case C4
For ERSP, we have been using **Pre 7.**
***** S7 and S8 are the left and right trials events, respectively

ERSP%



Preprocessing reports



Future work

Put every preprocessing into a single function without making it very confusing