More EEGLAB Scripting

Task 1
Load and epoch a continuous dataset
Plot an ERP image of a component
Script a command to 'value' sort ERP image

Task 2
Use `erpimage()` output to group ERPs

Task 3
Use `erpimage()` output to sort a new image

Task 4
Plot an ERP image with multiple subjects
-A word on component polarity

Exercise...
More EEGLAB Scripting

Task 1
Load and epoch a continuous dataset
Plot an ERP image of a component
Script a command to 'value' sort ERP image

Task 2
Use erpimage() output to group ERPs

Task 3
Use erpimage() output to sort a new image

Task 4
Plot an ERP image with multiple subjects
-A word on component polarity

Exercise...
Task 1: Load dataset and epoch
Task 1: Reject noisy epochs using auto-rejection
Task 1: Plot ERP image from gui

Plotting input data as 359 epochs of 750 frames sampled at 250.0 Hz.
Sorting data on input sorterv.
Smoothing the sorted epochs with a 10·epoch moving window.
and a decimation factor of 1
Output data will be 750 frames by 349 smoothed trials.
Outtrails: 6.00 to 354.00
The axis range will be the sym. abs. data range -> [-1.35755,1.35755].
Data will be plotted between -1000 and 1996 ms.
Overplotting sorted sorterv on data.
Plotting the ERP trace below the ERP image
Plotting a topoc map in upper left.
Done.
Task 1: Retrieve `erpimage()` call

Command executed by `pop_erpimage`:

```
erpimage( EEG.icaact([8], :), ones(1, EEG.trials)*EEG.xmax*1000, ...
EEG.times, linspace(EEG.xmin*1000, EEG.xmax*1000, EEG.pnts), 'Comp. 8', 10, 1, ...
'yerplabel','', 'topo', { EEG.icawinv(:,8) EEG.chanlocs EEG.chaninfo },...
'erp','cbar');
```

Plotting options/scalp map

Plot ERP and colorbar

How do I adapt this command to include more `erpimage()` options?

```
>> help erpimage
```
Task 1: Using help command to build script

```matlab
>> help erptime
erptime() - Image a collection of single-trial data epochs, optionally sorted on
and/or aligned to an input sorting variable or smoothed across trials
with a moving-average. (To return event-aligned data without plotting,
use eventlock()). Optionally sort trials on values, amplitude or phase
within a specified latency window. Optionally plot the ERP mean and
std. dev. and moving-window spectral amplitude and inter-trial coherence
at selected or peak frequency. Click on individual figures parts to
examine them separately and zoom (using axcopy()).

Usage:
>> [outdata, outvar, outtrials, limits, axhndis, erp, ...
amps, cohere, ochsig, ampsig, outamp, pshangles, pshamp, sortidx, erpsig] ...
   = erptime(data, sortvar, times, 'title', aewidth, decimate, ...)
     flag1, arg1, flag2, arg2, ...);

Necessary inputs:
  data - [vector or matrix] Single-channel input data to image.
    Formats (1, frames*trials) or (frames, trials)

Optional ordered inputs (with defaults):
  sortvar - [vector | []] Variable to sort epochs on (length(sortvar) = nepochs)
     Example: sortvar may by subject response time in each epoch (in ms)
     [default []: plot in input order]
  times - [vector | []] of latencies (ms) [length(times) = frames]
     Else [startsntimes start] Give start latency (ms), time points
     i.e. (frames) per epoch, sampling rate (Hz), [default []: 0:frames-1]
  'title' - [string] Plot title [default: none]
  aewidth - Number of trials to smooth with a moving-average (may be non-integer)
    [default: 0:1]
  decimate - Factor to decimate ntrials out by (may be non-integer) [default: 0:1]
    If this is large (> sqrt(num. trials)), output this many trials.

Unordered options ('keyword', argument pairs):

Optionally realign data epochs:
  'align' - [latency] Time-lock data to sortvar. Plot sortvar as at latency (ms)
    If latency == Inf, plot at sortvar median [default: no align]
```
Task 1: ERP image sorted by activation value

```matlab
valsort -[startms endms direction] Sort data by (mean) activation value between startms and endms. Direction is 1 or -1. If -1, plot max-value epoch at bottom.

%% VARIABLES
comp1 = 8; % Comp number to plot
data = squeeze(EEG.icaact(comp1,:,:));

sortvar = [];
startms = 580; % ms
endms = 620; % ms

smoothby = 1;

%% PLOT ERPIMAGE
figure;
[outdata, outvar, outtrials, limits, axhndls, ...
  erp, amps, coher, cohsig, ampsig, outamps, ...
  phsangs, phsamp, sortidx, erpsig] = ...
  erpimage(data, sortvar, times, 'title',...
            avewidth, decimate, flag1, arg1,...);
```

```matlab
%% VARIABLES
comp1 = 8; % Comp number to plot
data = squeeze(EEG.icaact(comp1,:,:));

sortvar = [];
startms = 580; % ms
endms = 620; % ms

smoothby = 1;

%% PLOT ERPIMAGE
figure;
[outdata, outvar, outtrials, limits, axhndls, ...
  erp, amps, coher, cohsig, ampsig, outamps, phsangs, ...
  phsamps, sortidx, erpsig] = ...
  erpimage(data, sortvar, EEG.times, ...'
            smoothby, 1,'valsort', [startms endms]);
```
More EEGLAB Scripting

Task 1
- Load and epoch a continuous dataset
- Plot an ERP image of a component
- Script a command to 'value' sort ERP image

Task 2
- Use `erpimage()` output to group ERPs

Task 3
- Use `erpimage()` output to sort a new image

Task 4
- Plot an ERP image with multiple subjects
  - A word on component polarity

Exercise...
Task 2: Separate trials using `erpimage()` output

**Objective:** Group and plot trials with low, middle and high amplitude ERPs

```matlab
lotrials = outdata(:, 1:120);
medtrials = outdata(:, 121:240);
hitrials = outdata(:, 241:end);

figure;
sbplot(3, 1, 1)plot(EEG.times, mean(lotrials, 2), 'b-');
sbplot(3, 1, 2)plot(EEG.times, mean(medtrials, 2), 'g-');
sbplot(3, 1, 3)plot(EEG.times, mean(hitrials, 2), 'r-');
```
Task 2: Plotting ERPs in Matlab

```matlab
lotrials = outdata(:, 1:120);
medtrials = outdata(:,121:240);
hitrials = outdata(:,241:end);

figure;
sbplot( 3, 1, 1)
plot(EEG.times, mean(lotrials,2), 'b-');
sbplot( 3, 1, 2)
plot(EEG.times, mean(medtrials,2), 'g-');
sbplot( 3, 1, 3)
plot(EEG.times, mean(hitrials,2), 'r-');
```

Find maximum range
Task 2: More Matlab plotting...

```matlab
lotrials = outdata(:, 1:120);
medtrials = outdata(:,121:240);
hitrials = outdata(:,241:end);
figure;
sbplot( 3, 1, 1)
plot(EEG.times, mean(lotrials,2), 'b-');
set(gca,'ylim',[-1 2]);

sbplot( 3, 1, 2)
plot(EEG.times, mean(medtrials,2), 'g-');
set(gca,'ylim',[-1 2]);

sbplot( 3, 1, 3)
plot(EEG.times, mean(hitrials,2), 'r-');
set(gca,'ylim',[-1 2]);
```
Task 2: More Matlab plotting...

```matlab
lotrials = outdata(:, 1:120);
medtrials = outdata(:,121:240);
hitrials = outdata(:,241:end);

figure;
sbplot( 3, 1, 1); hold on;
plot(EEG.times, mean(lotrials,2), 'b-');
set(gca,'ylim',[-1 2]);
plot([-1000 2000],[0 0], 'k:');
plot([0 0],[-1 2], 'k-');
title('Low ERP trials');

sbplot( 3, 1, 2); hold on;
plot(EEG.times, mean(medtrials,2),'g-');
set(gca,'ylim',[-1 2]);
plot([-1000 2000],[0 0], 'k:');
plot([0 0],[-1 2], 'k-');
title('Mid ERP trials');

sbplot( 3, 1, 3); hold on;
plot(EEG.times, mean(hitrials,2), 'r-');
set(gca,'ylim',[-1 2]);
plot([-1000 2000],[0 0], 'k:');
plot([0 0],[-1 2], 'k-');
title('High ERP trials');
```
More EEGLAB Scripting

Task 1
Load and epoch a continuous dataset
Plot an ERP image of a component
Script a command to 'value' sort ERP image

Task 2
Use `erpimage()` output to group ERPs

Task 3
Use `erpimage()` output to sort a new image

Task 4
Plot an ERP image with multiple subjects
-A word on component polarity

Exercise...
Task 3: Use sort index to sort a new ERP image

```matlab
%% VARIABLES
comp1 = 8;
data = squeeze(EEG.icaact(comp1,:,:));
sortvar = [];
startms = 580;
endms = 620;
smoothby = 1;

%% PLOT ERPIMAGE
figure;
[outdata, outvar, outtrials, limits, axhndls, erp, ...
amps, coher, cohsig, ampsig, outamps, phsangls, phsamps ...
sortidx, erpsig] = erpimage( data, sortvar, EEG.times, ...
', smoothby, 1, 'valsорт', [startms endms]);
```
Task 3: Index definition

```matlab
>> my_numbers = [101,102,103,104,105,106,107,108,109,110];
my_numbers =

101 102 103 104 105 106 107 108 109 110

>> new_order = [8,2,5,1,10,9,4,6,3,7]; % analogous to sortidx
>> my_numbers(new_order)
ans =

108 102 105 101 110 109 104 106 103 107
```
Task 3: Using sort index to sort a new ERP image

%%% VARIABLES %%%%comp1 = 8;
data = squeeze(EEG.icaact(comp1,:,:));
sortvar = [];
startms = 580;
endms = 620;
smoothby = 1;

1st ERPIMAGE %%%%figure;
[outdata,outvar,outtrials,limits,axhndls,erp,...
amps,cohers,cohsig,ampsig,outamps,phsangls,...
phsamps,sortidx,erpsig] = erpimage(data,sortvar,...
EEG.times,'',smoothby,1,'valsort',[startms endms]);

2nd ERPIMAGE %%%%comp2 = 16;
data2 = squeeze(EEG.icaact(comp2,:,:));
minfrq = 9; % specify freq range for
maxfrq = 12; % amplitude plot
smoothby = 20;
figure;
[outdata,outvar,outtrials,limits,axhndls,erp,...
cohers,cohsig,ampsig,outamps,phsangls,phsamps,sortidx2,erpsig] ...
= erpimage(data2,sortvar,EEG.times,['Component ',int2str(comp2)],...
smoothby,1,'coher',[minfrq maxfrq .01],'plotamps');

Objective: Use sort order (sortidx) from 'valsort' of comp1 to create a new ERP image of another component with the same sort order.
More EEGLAB Scripting

Task 1
Load and epoch a continuous dataset
Plot an ERP image of a component
Script a command to 'value' sort ERP image

Task 2
Use `erpimage()` output to group ERPs

Task 3
Use `erpimage()` output to sort a new image

Task 4
Plot an ERP image with multiple subjects
-A word on component polarity

Exercise...
Task 4: Collect and plot data across subjects

% Load two epoched datasets, from two different subjects

%%%%% VARIABLES  %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%  
% Create a cell array with comps of interest
plotcomps{1} = [10];  % subject 1
plotcomps{2} = [6];  % subject 2
sortvar = [];
smoothby = 10;

%%%% COLLECT DATA %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

data = [];
for subj = 1:length(plotcomps)
    [EEG ALLEEG CURRENTSET] = eeg_retrieve(ALLEEG,subj);
scalefac = sqrt(mean(EEG.icawinv(:,plotcomps{subj}).^2));  % root mean square (RMS)
data = [data squeeze(EEG.icaact(plotcomps{subj},:,:))*scalefac];
end;

%%%% PLOT ERPIMAGE %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure;
[outdata,outvar, outtrials,limits, axhndls, erp, amps, coher, cohsig, ampsig, outamps, 
phsangls, phsamps, sortidx, erpsig] ...  
= erpimage( data, sortvar, EEG.times, 'Component Cluster ERPimage’, smoothby , 1);
Task 4: Dealing with orientation

Activation/scalp map polarity is arbitrary (!)
- There IS an absolute orientation for each ELECTRODE when back-projected...
- But you have to determine WHICH scalp location interests you

Therefore:
1) pick one channel's activation orientation
2) orient all subjects the same way

```matlab
data = [];
for subj = 1:length(plotcomps)
    [EEG ALLEEG CURRENTSET] = eeg_retrieve(ALLEEG,subj);
scalefac = sqrt(mean(EEG.icawinv(:,plotcomps{subj}).^2));
if subj == 2
    data = [data squeeze(EEG.icaact(plotcomps{subj},:,:))*scalefac * -1];  \% reverse
else
    data = [data squeeze(EEG.icaact(plotcomps{subj},:,:))*scalefac];
end;
end;
```
Task 4: Correctly oriented activations

```matlab
%% PLOT ERPIMAGE
figure;
[outdata,outvar, outtrials,limits, axhndls, erp, ...
amps, coher, cohsig, ampsig, outamps, phsangls, ...
phsamps,sortidx, erpsig] = erpimage(data, sortvar,...
EEG.times,'Cluster comps', smoothby, 1, 'erp', 'cbar');
```
Exercise

• Load '.../data/faces_3.set'
• Epoch on 'object' and 'face' stimuli
• Remove any noisy epochs
• 'valsort' the ERP of component 10 at 150 ms
• Intermediate:
  • Collect sortidx output
  • Apply sort order to an activation time course ERP image of component 4 (try different smoothing factors)
• Advanced:
  • Include RTs (use 'eegh' from gui command) in 'valsort' plot
  • above and determine mean/std of RTs for low, mid and high amplitude trials.
  • Is there an effect of ERP size on RT?