Save as docfig

In style of academic paper

The protocol should be the same as the 1st experiment

Clear all

Close all

Clc

Type .lda if you don’t understand anything

Mean=The average across 16 epochs

2 Hz bins: 256 is the Nyquist frequency, divide it by 2 and we got 128

Bandpass is used to -> check literature

If you debounce less than 0.5, you would get a lower psd magnitude

Remove 2 s before and after: Artefact of blinking

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% Implements supplementary\_code/part\_2/extract\_epochs.m

% CODE 1

% Find length of signal

L = length(S);

% Differentiate trigger channel

delta\_trig = S(2:L,17) - S(1:L-1,17);

% Look for rising edges

trig = find(delta\_trig>0);

% Debounce if required

% I.e. remove spurious short triggers, if any

% these can occur when using a manual switch-based trigger

% e.g. look at the trigger channel in 'data\_files/c30o30\_s4\_t1.bdf'

Fs = 1;

T\_debounce = 0.5; % (in seconds) - set as desired

dt\_trig = trig(2:end) - trig(1:end-1);

delete\_short\_trigs = find(dt\_trig < Fs\*T\_debounce) + 1;

trig(delete\_short\_trigs) = [];

% How many triggers were extracted in total, after debouncing?

N\_trigs = length(trig)-1;

% Ensure we have an odd number of triggers (ignore final incomplete

% epoch if not).

% Trigger 1 = start of experiment

% Triggers 2, 4, 6, 8... (2k) = eyes closed

% Triggers 3, 5, 7, 9... (2k+1) = eyes open

if mod(N\_trigs, 2) == 0

N\_trigs = N\_trigs - 1;

end

disp(cell2mat(strcat({'Found '}, int2str(N\_trigs), {' triggers.'})));

N\_epochs = N\_trigs;

% Discard 2 seconds of data before & after each cue

discard = 2\*Fs;

% Extract each epoch of data and store in the relevant structure for

% each class

% - eyes\_closed (even triggers)

% - eyes\_open (odd triggers)

for i=1:N\_epochs/2

eyes\_closed{i} = S(trig(2\*i)+discard:trig(2\*i+1)-discard,1:16);

eyes\_open{i} = S(trig(2\*i+1)+discard:trig(2\*i+2)-discard,1:16);

end

% CODE 2

% Specify the electrode montage on scalp (the electrode numbers laid out

% in a matrix, according to their positions on the scalp and as we want

% them to be displayed

montage = [-1 -1 1 -1 -1; 2 3 4 5 6; 7 8 9 10 11; 12 13 14 15 16];

% The 10/20 labels for each electrode channel (again, corresponding to the

% montage above. In this case electrode 1 = Fz, electrode 2 = FC3,

% electrode 3 = FC1 etc.

electrode\_labels = {'Fz', 'FC3', 'FC1', 'FCz', 'FC2', 'FC4','C3', 'C1', 'Cz', 'C2', 'C4','CP3', 'CP1', 'CPz', 'CP2', 'CP4', 'P3', 'P1', 'PZ', 'P2', 'P4'};

% Create a new figure (or select an existing one if you prefer)

figure

% Iterate through each row (j) and column (i) of the montage matrix that

% will form your subplot figure

for j=1:4

for i=1:5

% Only create plots for electrodes that exist (ignore -1 values)

if montage(j, i) > 0

% which electrode is at this location in the montage matrix?

electrode = montage(j, i);

% select the correct (row, colum) --> what does the number 5 do

% here?

subplot(4, 5, i+(5\*(j-1)))

% plot something for the current electrode. You can plot

% whatever data you want here, but for example:

X\_fft = fft(FFt2)

plotFFT2(X\_fft, Fs)

% Set axes limits if necessary, e.g.

ylim([0 25000])

xlim([0 40])

% Label each subplot with the corresponding electrode poistion

title(electrode\_labels{electrode})

% Label the axes for the bottom left plot only (to prevent the

% figure getting too crowded and illegible)

if i == 1 && j == 4

xlabel('Frequency (Hz)');

ylabel('FFT (V)')

end

end

end

end

% Add a title to the entire plot - play around, as required

annotation('textbox', [0.1,0.75, 0.2, 0.2], 'String', 'Eyes Open','FontWeight', 'bold', 'LineStyle', 'none')

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clear all; close all; clc;

[S HDR] = sload('data\_files/c30o30\_s4\_t1.bdf');

Fs=HDR.SampleRate;

for i=1:17

figure

plot(S(:,i))

end

% Implements supplementary\_code/part\_2/extract\_epochs.m

% Find length of signal

L = length(S);

% Differentiate trigger channel

delta\_trig = S(2:L,17)-S(1:L-1,17);

% Look for rising edges

trig = find(delta\_trig>0);

% Debounce if required

% I.e. remove spurious short triggers, if any

% these can occur when using a manual switch-based trigger

% e.g. look at the trigger channel in 'data\_files/c30o30\_s4\_t1.bdf'

T\_debounce = 0.5; % (in seconds) - set as desired

dt\_trig = trig(2:end) - trig(1:end-1);

delete\_short\_trigs = find(dt\_trig < Fs\*T\_debounce) + 1;

trig(delete\_short\_trigs) = [];

% How many triggers were extracted in total, after debouncing?

N\_trigs = length(trig)-1;

% Ensure we have an odd number of triggers (ignore final incomplete

% epoch if not).

% Trigger 1 = start of experiment

% Triggers 2, 4, 6, 8... (2k) = eyes closed

% Triggers 3, 5, 7, 9... (2k+1) = eyes open

if mod(N\_trigs, 2) == 0

N\_trigs = N\_trigs - 1;

end

disp(cell2mat(strcat({'Found '}, int2str(N\_trigs), {' triggers.'})));

N\_epochs = N\_trigs;

% Discard 2 seconds of data before & after each cue

discard = 2\*Fs;

% Extract each epoch of data and store in the relevant structure for

% each class

% - eyes\_closed (even triggers)

% - eyes\_open (odd triggers)

for i=1:N\_epochs/2

eyes\_closed{i} = S(trig(2\*i)+discard:trig(2\*i+1)-discard,1:16);

eyes\_open{i} = S(trig(2\*i+1)+discard:trig(2\*i+2)-discard,1:16);

end

% CODE 2

% Specify the electrode montage on scalp (the electrode numbers laid out

% in a matrix, according to their positions on the scalp and as we want

% them to be displayed

montage = [-1 -1 1 -1 -1; 2 3 4 5 6; 7 8 9 10 11; 12 13 14 15 16];

% The 10/20 labels for each electrode channel (again, corresponding to the

% montage above. In this case electrode 1 = Fz, electrode 2 = FC3,

% electrode 3 = FC1 etc.

electrode\_labels = {'Fz', 'FC3', 'FC1', 'FCz', 'FC2', 'FC4','C3', 'C1', 'Cz', 'C2', 'C4','CP3', 'CP1', 'CPz', 'CP2', 'CP4', 'P3', 'P1', 'PZ', 'P2', 'P4'};

% Create a new figure (or select an existing one if you prefer)

% Iterate through each row (j) and column (i) of the montage matrix that

% will form your subplot figure

%eo\_fft = ssfft(eyes\_open{:,1});

figure

for j=1:4

for i=1:5

% Only create plots for electrodes that exist (ignore -1 values)

if montage(j, i) > 0

% which electrode is at this location in the montage matrix?

electrode = montage(j, i);

% select the correct (row, colum) --> what does the number 5 do

% here?

subplot(4, 5, i+(5\*(j-1)))

% plot something for the current electrode. You can plot

% whatever data you want here, but for example:

ec\_fft = ssfft(eyes\_closed{:,1});

plotFFT2(ec\_fft(:,electrode), Fs)

% Set axes limits if necessary, e.g.

ylim([0 250])

xlim([0 40])

% Label each subplot with the corresponding electrode poistion

title(electrode\_labels{electrode})

% Label the axes for the bottom left plot only (to prevent the

% figure getting too crowded and illegible)

if i == 1 && j == 4

xlabel('Frequency (Hz)');

ylabel('FFT (V)')

end

end

end

end

% Add a title to the entire plot - play around, as required

annotation('textbox', [0.1,0.75, 0.2, 0.2], 'String', 'Eyes Closed','FontWeight', 'bold', 'LineStyle', 'none')

figure

for j=1:4

for i=1:5

% Only create plots for electrodes that exist (ignore -1 values)

if montage(j, i) > 0

% which electrode is at this location in the montage matrix?

electrode = montage(j, i);

% select the correct (row, colum) --> what does the number 5 do

% here?

subplot(4, 5, i+(5\*(j-1)))

% plot something for the current electrode. You can plot

% whatever data you want here, but for example:

eo\_fft = ssfft(eyes\_open{:,1});

plotFFT2(eo\_fft(:,electrode), Fs)

% Set axes limits if necessary, e.g.

ylim([0 25000])

xlim([0 40])

% Label each subplot with the corresponding electrode poistion

title(electrode\_labels{electrode})

% Label the axes for the bottom left plot only (to prevent the

% figure getting too crowded and illegible)

if i == 1 && j == 4

xlabel('Frequency (Hz)');

ylabel('FFT (V)')

end

end

end

end

% Add a title to the entire plot - play around, as required

annotation('textbox', [0.1,0.75, 0.2, 0.2], 'String', 'Eyes Open','FontWeight', 'bold', 'LineStyle', 'none')

figure

for j=1:4

for i=1:5

% Only create plots for electrodes that exist (ignore -1 values)

if montage(j, i) > 0

% which electrode is at this location in the montage matrix?

electrode = montage(j, i);

% select the correct (row, colum) --> what does the number 5 do

% here?

subplot(4, 5, i+(5\*(j-1)))

% plot something for the current electrode. You can plot

% whatever data you want here, but for example:

% eo\_fft = ssfft(eyes\_open{:,1});

% plotFFT2(eo\_fft(:,electrode), Fs)

eyes\_open\_fft(:,electrode) = ssfft(eyes\_open{:,i}(:,electrode));

eyes\_open\_PSD(:,electrode) = eyes\_open\_fft(:,electrode).^2

% plotFFT2(X\_fft, Fs)

plotFFT2(eyes\_open\_PSD(:,electrode),Fs)

% Set axes limits if necessary, e.g.

ylim([0 250])

xlim([0 10])

% Label each subplot with the corresponding electrode poistion

title(electrode\_labels{electrode})

% Label the axes for the bottom left plot only (to prevent the

% figure getting too crowded and illegible)

if i == 1 && j == 4

xlabel('Frequency (Hz)');

ylabel('FFT (V)')

end

end

end

end

% Add a title to the entire plot - play around, as required

annotation('textbox', [0.1,0.75, 0.2, 0.2], 'String', 'Eyes Open Psd','FontWeight', 'bold', 'LineStyle', 'none')

figure

for j=1:4

for i=1:5

% Only create plots for electrodes that exist (ignore -1 values)

if montage(j, i) > 0

% which electrode is at this location in the montage matrix?

electrode = montage(j, i);

% select the correct (row, colum) --> what does the number 5 do

% here?

subplot(4, 5, i+(5\*(j-1)))

% plot something for the current electrode. You can plot

% whatever data you want here, but for example:

eo\_fft = ssfft(eyes\_open{:,1});

plotPSD(eo\_fft(:,electrode), Fs)

% Set axes limits if necessary, e.g.

ylim([0 250])

xlim([0 10])

% Label each subplot with the corresponding electrode poistion

title(electrode\_labels{electrode})

% Label the axes for the bottom left plot only (to prevent the

% figure getting too crowded and illegible)

if i == 1 && j == 4

xlabel('Frequency (Hz)');

ylabel('FFT (V)')

end

end

end

end

% Add a title to the entire plot - play around, as required

annotation('textbox', [0.1,0.75, 0.2, 0.2], 'String', 'Eyes Open Psd','FontWeight', 'bold', 'LineStyle', 'none')