

## Progress Report for 25 August 2015

- Extracted relevant data channels (T7, T8, P7, P8, AF3, AF4, F3, F4) from 1v1 physical recording data, performed band-pass filter, computed cross-correlations between single-channel data:

```
1 - clear
2 - %load desired .mat file
3 - load('/Users/Jon/Desktop/Social_Neuroscience/recordings/1v1physical/EEGlog-P1AH1C2M2b -20150701T143228.mat', 'recordData')
4 - testData1 = recordData;
5 - load('/Users/Jon/Desktop/Social_Neuroscience/recordings/1v1physical/EEGlog-P1BH2C2M2b-20150701T143127.mat', 'recordData')
6 - testData2 = recordData;
7 -
8 - %extracting desired data channels
9 - fullfilextractedData1 = testData1(:,4:17);
10 - fullfilextractedData1(:, 2) = [];
11 - fullfilextractedData1(:, 3) = [];
12 - fullfilextractedData1(:, 5) = [];
13 - fullfilextractedData1(:, 5) = [];
14 - fullfilextractedData1(:, 7) = [];
15 - fullfilextractedData1(:, 8) = [];
16 -
17 - fullfilextractedData2 = testData2(:,4:17);
18 - fullfilextractedData2(:, 2) = [];
19 - fullfilextractedData2(:, 3) = [];
20 - fullfilextractedData2(:, 5) = [];
21 - fullfilextractedData2(:, 5) = [];
22 - fullfilextractedData2(:, 7) = [];
23 - fullfilextractedData2(:, 8) = [];
24 -
25 - %applying band-pass filter to delta freq band
26 - delta1 = Band_pass_filter(fullfilextractedData1,1,4,128);
27 - delta2 = Band_pass_filter(fullfilextractedData2,1,4,128);
28 -
29 - %extracting single channel data for cross-correlation
30 - single1 = delta1(:,1);
31 - single2 = delta2(:,1);
32 -
33 - %compute xcorr
34 - xcorrelation = xcorr(single1, single2);
35 -
```

- Sample EEG data (EEGlog-P1AH1C2M2b -20150701T143228.mat) for reference:

|    | 3 | 4          | 5          | 6          | 7          | 8          | 9          | 10         | 11         | 12         | 13         | 14         | 15         | 16         | 17         | 18   |
|----|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------|
| 1  | 0 | 4.2641e... | 4.2841e... | 4.2313e... | 4.2205e... | 4.2692e... | 4.2626e... | 4.2492e... | 4.2446e... | 4.1651e... | 4.2523e... | 4.2549e... | 4.2338e... | 4.2564e... | 4.2405e... | 1670 |
| 2  | 0 | 4.1903e... | 4.1877e... | 4.1933e... | 4.1872e... | 4.1887e... | 4.1887e... | 4.1877e... | 4.1897e... | 4.1918e... | 4.1892e... | 4.1887e... | 4.1897e... | 4.1882e... | 4.1887e... | 1670 |
| 3  | 0 | 4.2000e... | 4.2062e... | 4.2046e... | 4.1872e... | 4.1995e... | 4.2026e... | 4.1969e... | 4.1959e... | 4.1682e... | 4.1918e... | 4.1949e... | 4.1944e... | 4.1969e... | 4.1928e... | 1670 |
| 4  | 0 | 4.3395e... | 4.3718e... | 4.2615e... | 4.2733e... | 4.3518e... | 4.3338e... | 4.3159e... | 4.3072e... | 4.1856e... | 4.3231e... | 4.3282e... | 4.2877e... | 4.3297e... | 4.3041e... | 1671 |
| 5  | 0 | 3.8195e... | 3.6892e... | 4.0010e... | 4.0631e... | 3.7887e... | 3.8185e... | 3.8897e... | 3.9297e... | 4.4108e... | 3.8882e... | 3.8713e... | 3.9923e... | 3.8610e... | 3.9538e... | 1673 |
| 6  | 0 | 3.0667e... | 2.6969e... | 3.6415e... | 3.8523e... | 2.9785e... | 3.0938e... | 3.3251e... | 3.4133e... | 4.8636e... | 3.2687e... | 3.2303e... | 3.6108e... | 3.2082e... | 3.4979e... | 1673 |
| 7  | 1 | 3.1323e... | 2.7231e... | 3.6800e... | 4.0800e... | 3.0487e... | 3.1574e... | 3.4554e... | 3.5256e... | 5.2185e... | 3.3974e... | 3.3467e... | 3.7441e... | 3.3169e... | 3.6477e... | 1676 |
| 8  | 3 | 3.3021e... | 2.9590e... | 3.7882e... | 4.1262e... | 3.2272e... | 3.3221e... | 3.5867e... | 3.6431e... | 5.0882e... | 3.5590e... | 3.4949e... | 3.8303e... | 3.4662e... | 3.7415e... | 1675 |
| 9  | 4 | 3.1600e... | 2.8067e... | 3.7256e... | 4.0010e... | 3.0867e... | 3.1969e... | 3.4600e... | 3.5215e... | 4.9985e... | 3.4256e... | 3.3549e... | 3.7149e... | 3.3292e... | 3.6174e... | 1678 |
| 10 | 8 | 3.1795e... | 2.8097e... | 3.7318e... | 4.0651e... | 3.1292e... | 3.2221e... | 3.5056e... | 3.5605e... | 5.1174e... | 3.4810e... | 3.3990e... | 3.7544e... | 3.3682e... | 3.6677e... | 1678 |
| 11 | 5 | 3.2359e... | 2.8969e... | 3.7744e... | 4.0800e... | 3.2118e... | 3.2892e... | 3.5626e... | 3.6067e... | 5.0626e... | 3.5436e... | 3.4533e... | 3.7877e... | 3.4221e... | 3.6938e... | 1679 |
| 12 | 3 | 3.2190e... | 2.8928e... | 3.7713e... | 4.0641e... | 3.2200e... | 3.2918e... | 3.5677e... | 3.6067e... | 5.0446e... | 3.5292e... | 3.4462e... | 3.7795e... | 3.4123e... | 3.6785e... | 1679 |
| 13 | 4 | 3.2154e... | 2.8938e... | 3.7697e... | 4.0636e... | 3.2200e... | 3.2887e... | 3.5744e... | 3.6179e... | 5.0677e... | 3.5446e... | 3.4610e... | 3.7846e... | 3.4236e... | 3.6759e... | 1680 |
| 14 | 0 | 3.2082e... | 2.9010e... | 3.7590e... | 4.0549e... | 3.1887e... | 3.2708e... | 3.5605e... | 3.6026e... | 5.0323e... | 3.5477e... | 3.4533e... | 3.7733e... | 3.4226e... | 3.6590e... | 1680 |
| 15 | 0 | 3.1949e... | 2.8990e... | 3.7508e... | 4.0492e... | 3.1805e... | 3.2656e... | 3.5538e... | 3.5897e... | 5.0031e... | 3.5338e... | 3.4446e... | 3.7641e... | 3.4144e... | 3.6574e... | 1680 |
| 16 | 0 | 3.1892e... | 2.9021e... | 3.7549e... | 4.0410e... | 3.2154e... | 3.2754e... | 3.5636e... | 3.5985e... | 4.9985e... | 3.5359e... | 3.4538e... | 3.7687e... | 3.4174e... | 3.6559e... | 1682 |
| 17 | 0 | 3.1979e... | 2.9205e... | 3.7615e... | 4.0569e... | 3.2487e... | 3.2872e... | 3.5831e... | 3.6118e... | 5.0097e... | 3.5605e... | 3.4703e... | 3.7795e... | 3.4349e... | 3.6621e... | 1681 |
| 18 | 0 | 3.1979e... | 2.9272e... | 3.7605e... | 4.0559e... | 3.2518e... | 3.2867e... | 3.5846e... | 3.6062e... | 4.9867e... | 3.5559e... | 3.4713e... | 3.7754e... | 3.4385e... | 3.6677e... | 1681 |
| 19 | 0 | 3.1933e... | 2.9251e... | 3.7600e... | 4.0497e... | 3.2513e... | 3.2846e... | 3.5836e... | 3.6082e... | 4.9779e... | 3.5405e... | 3.4738e... | 3.7759e... | 3.4395e... | 3.6703e... | 1678 |
| 20 | 0 | 3.1985e... | 2.9395e... | 3.7682e... | 4.0610e... | 3.2523e... | 3.2882e... | 3.5964e... | 3.6267e... | 4.9979e... | 3.5646e... | 3.4933e... | 3.7928e... | 3.4590e... | 3.6785e... | 1678 |
| 21 | 0 | 3.1995e... | 2.9497e... | 3.7718e... | 4.0621e... | 3.2446e... | 3.2887e... | 3.6062e... | 3.6262e... | 4.9923e... | 3.5928e... | 3.5031e... | 3.7979e... | 3.4718e... | 3.6841e... | 1675 |
| 22 | 0 | 3.2046e... | 2.9621e... | 3.7795e... | 4.0697e... | 3.2733e... | 3.3031e... | 3.6246e... | 3.6308e... | 4.9826e... | 3.6138e... | 3.5092e... | 3.8021e... | 3.4795e... | 3.6918e... | 1673 |
| 23 | 0 | 3.2046e... | 2.9703e... | 3.7913e... | 4.0769e... | 3.3041e... | 3.3154e... | 3.6369e... | 3.6456e... | 4.9867e... | 3.6272e... | 3.5113e... | 3.8062e... | 3.4800e... | 3.6892e... | 1673 |
| 24 | 0 | 3.2010e... | 2.9687e... | 3.7892e... | 4.0631e... | 3.2933e... | 3.3062e... | 3.6303e... | 3.6431e... | 4.9718e... | 3.6097e... | 3.5041e... | 3.8000e... | 3.4764e... | 3.6795e... | 1667 |
| 25 | 0 | 3.1990e... | 2.9651e... | 3.7754e... | 4.0497e... | 3.2682e... | 3.2964e... | 3.6256e... | 3.6297e... | 4.9369e... | 3.5769e... | 3.4887e... | 3.7903e... | 3.4636e... | 3.6651e... | 1670 |
| 26 | 0 | 3.1815e... | 2.9436e... | 3.7667e... | 4.0415e... | 3.2574e... | 3.3031e... | 3.6333e... | 3.6287e... | 4.9210e... | 3.5600e... | 3.4708e... | 3.7841e... | 3.4333e... | 3.6431e... | 1677 |
| 27 | 0 | 3.1826e... | 2.9456e... | 3.7795e... | 4.0446e... | 3.2974e... | 3.3215e... | 3.6554e... | 3.6574e... | 4.9467e... | 3.6082e... | 3.5051e... | 3.8036e... | 3.4626e... | 3.6605e... | 1673 |
| 28 | 0 | 3.2041e... | 2.9697e... | 3.7908e... | 4.0554e... | 3.3405e... | 3.3251e... | 3.6626e... | 3.6759e... | 4.9636e... | 3.6708e... | 3.5549e... | 3.8231e... | 3.5277e... | 3.6908e... | 1671 |

- Band-pass filter function:

```

1 function EEG_signal_filt = Band_pass_filter(EEG_signal,Cut_off_freq_1,Cut_off_freq_2,Fs)
2
3 % Function to implement band-pass filtering using FIR filter.
4
5 % Usage: EEG_signal_filt = Band_pass_filter(EEG_signal,Cut_off_freq_1,Cut_off_freq_2,Fs)
6 % Input:
7 %     EEG_signal - Referenced EEG signal
8 %     Cut_off_freq_1 & Cut_off_freq_2 - cut-off frequencies in linear
9 %                                     scale (in hertz)
10 %     Fs - sampling frequency in Hertz
11 % Output:
12 %     EEG_signal_filt - Band-pass filtered EEG signal
13
14 % Preamble
15 Nyquist_freq = Fs/2;
16 [Num_chan Temp] = size(EEG_signal);
17
18 % FIR filter of order 100
19 % Normalized frequencies
20 W = [Cut_off_freq_1 Cut_off_freq_2]/Nyquist_freq;
21 Filter_coeffs = fir1(100,W);
22
23 for i=1:Num_chan,
24     EEG_signal_filt(i,:) = filter(Filter_coeffs,1,EEG_signal(i,:));
25 end
26

```

- Cross-correlation results:

|    | 1        | 2 |
|----|----------|---|
| 1  | 5.7898   |   |
| 2  | 11.4779  |   |
| 3  | 17.1821  |   |
| 4  | 23.0777  |   |
| 5  | 28.2729  |   |
| 6  | 32.4446  |   |
| 7  | 36.6893  |   |
| 8  | 41.1556  |   |
| 9  | 45.4358  |   |
| 10 | 49.7524  |   |
| 11 | 54.1553  |   |
| 12 | 58.5450  |   |
| 13 | 62.9281  |   |
| 14 | 67.2913  |   |
| 15 | 71.6355  |   |
| 16 | 75.9698  |   |
| 17 | 80.3108  |   |
| 18 | 84.6532  |   |
| 19 | 88.9940  |   |
| 20 | 93.3433  |   |
| 21 | 97.6918  |   |
| 22 | 102.0520 |   |
| 23 | 106.4235 |   |
| 24 | 110.7936 |   |
| 25 | 115.1308 |   |
| 26 | 119.4489 |   |

### Comments:

1. Cross-correlation results do not correspond with expected range of [-1,1]. Need to identify sources of error in presented code and/or data.
2. Compilation time is fairly significant: Between 5 to 10s for current code presented above.
3. Data extraction code may be further condensed and called in functions.