**BE 3343-009 team-student project / BE 5343-009 single-student project**

**(Spring 2022)**

**Due 11:59 pm May 13, 2022**

You are given a set of EEG data, **EEG\_data1\_short.mat**, which is in the **Class Project folder** in Canvas. Note that **EEG\_data1\_short.mat** is a structure array and can be read in matlab. I will demonstrate how to open it in class on Monday if you do not know how to open it. Or you can read the text on page 92-96 on the Matlab (electronic) textbook if you wish.

After you open this structure array, please identify two sub-arrays: **EEG.times and EEG.data**. You need only these two sets of data for your project. EEG.times is a 1x200 array and gives a time series with a time interval of 256 ms, and EEG.data is a 19x200 array and corresponds to 19 channels of EEG array. Then, follow the instruction below for your project.

***Topic 1: Introductions (knowledge about EEG, general time-domain analysis, and topography)***

Your tasks for this topic include two operations, one for time-domain and the other for topography:

Time-domain analysis (30 pts):

1. To plot time versus EEG signal from (1) one of the 19 channels and (2) the mean of 19 channels. Please plot them together in the same figure with x-label, y-label, and figure title.

(8 pts)

1. To perform Fourier transform on the averaged signal and then select appropriate range for low-pass filtering; then plot the un-filtered and filtered frequency curves in the same figure with correct x-label, y-label, and figure title. (8 pts)
2. Obtain the filtered curve, followed by plotting the unfiltered and filtered time-domain mean EEG signal over 19 channels in the same figure with correct labels and figure title. (8 pts)
3. Print out your explanation on what you obtain and learn form the operation you did. (6 pts)

Topography (60 pts):

1. To provide a follow chart about how to obtain an EEG topography (5 pts)
2. Explain the purpose or meaning of the following syntaxes: (25 pts)
3. [elocsX,elocsY] = pol2cart(pi/180\*[EEG.chanlocs.theta],[EEG.chanlocs.radius])
4. scatter(elocsY,elocsX,100,'ro','filled');
5. set(gca,'xlim',[-.6 .6],'ylim',[-.6 .6])
6. interp\_detail = 100
7. interpFunction(gridX,gridY)
8. To obtain a 19-channel layout with interpolation marks in the cartesian coordinate system with correct x- and y- labels (15 pts)
9. Plot three topographies of 19-channel EEG at one particular time or during a period of time using three different ways, following the code you downloaded, with appropriate x label, y label, and figure title. (15 pts)
10. PDF file output with figures included; also adequate comments in the code (10 pts)
11. **Extra points (10 pts):**

To make the layout and topography to be in the dimension of 20 cm in both x and y axis.

***Topic 2: Discrete time Fourier transform***

***Topic 3: Pre-processing for EEG data***

Each group submits a report including the flow chart, MATLAB code (using “publish” format), brief descriptions, and images to represent the required steps.

***Note 1:*** *you do not have to be perfect or to complete every step in order to get good credits.*

***Note 2:*** *You can complete many tasks based on what you have learned from the class, meaning that you do not have to use new MATLAB predefined commands/functions if you can find your own ways. It is important that you learn details of new functions if you use them.*