EEG and Arithmetic

Electroencephalograms (EEG) are recordings of brain activity. During this painless test, small sensors are attached to the scalp to pick up the electrical signals produced by the brain. Brain cells communicate via electrical impulses and are active all the time, even during asleep. This activity shows up as wavy lines on an EEG recording.

An EEG is one of the main diagnostic tests for epilepsy. An EEG can also play a role in diagnosing other brain activity and disorders

Physics and Math Background

EEGs are a signal and like any signal can be analyzed using Fourier Techniques. The spectrum of the time signal can provide clues to what is happening in the brain when a siezure occurs. All the mathematics needed for this have been discussed in class.

The Project

In this project you will download data and analyze an EEG of patients undergoing EEGs before performing an artithemtic task, and then during the task. The files can be downloaded from: **/https://www.physionet.org/content/eegmat/1.0.0/**. This page also provides some background information and references that you can use for this projet.

Several sets of data. Make sure they are downloades as pairs, that is, with the suffixs **_1, _2**. The suffix 1 is the recording of the background EEG of a subject (before mental arithmetic task), the suffix 2 is the recording of EEG during the mental arithmetic task.

The files are in a binary format called *European data format* or edf. `MatLab` has a built in command to read these files. The command is `edfread(<filename>)`. The file is in a structure called a *cell*. You can think of a cell as a structure whose elements are arrays. This can be tricky to work with at first. Because of this, I provide more in-depth description of how to extract the data once you have read it into `MatLab`.

```
data = edfread('Subject03_1.edf');');  % read the data file
% data has 21 cells so next line would be in a loop
dt=data{:,n};   % get all the data in the nth cell
data1 = cell2mat(dt) % convert the cell to a matrix
%% data is now ready to manipulate
```

The data files are quite large. You will first plot the data and you should be able to identify where the seizure is occurring in at least one of the the channels. (The channels basically correspond to one of the sensors).

You will then want to analyze the data by examining the spectra during the of the various patients to see if you can tell the difference between the Group G and Group B subjects as well the difference in individual subjects when doing the arithmetic task and when not. You may want to do this by breaking up the data into blocks of data and `fft-ing` each block. You will want identify any features that appear to be important and that distinguish the groups.

References:

All references can be found on the web page above.