EEG and Siezures

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 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 patient having a siezure, just before, during ,and then after the seizure occurs. The files can be downloadee from:`https://www.physionet.org/content/chbmit/1.0.0/`. This page also provides some background information and references that you can use for this projet.

Download data that are close to each other in time and that bracket a seizure. For example, in the folder `chb10` the files `chb10_19.edf, chb10_20.edf, chb_21.edf` are appropriate. You can find others by looking in the file `chb10-summary.txt`

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`.

```
seg1 = edfread('chb10_19.edf');  % read the data file
% data has 23 cells so next line would be in a loop
dt=seg1{:,n};   % get all the data in the nth cell
data = 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).

There will be two main parts to your analysis:

(1) You will want to analyze the data by examining the spectra during the seizure and away from seizure. 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 seizure from non-seizure, as well as trying to characterize the seizure itself, if possible.

(2) Find other seizure files in the same folder. Fourier analyze the sections of the files that contain the seizure and look for similarities and differences in the spectra of the seizures.

References:

All references can be found on the web page above.