Neuroscience Gateway Internship 2020 REHS Program

Students: Valeria Aguilar(Steele Canyon), Musab Kazmi (National University Academy), Brenda Rojas (Helix)

Mentors: Ramón Martinez-Cancino[1], Dung Truong[1], Kenneth Yoshimoto[2], Subha Sivagnanam[2], Amitava Majumdar[2]
1Swartz Center for Computational Neuroscience, 2San Diego Supercomputer Center
University of California San Diego

Outline

- Parallel Computing
- Electroencephalography (EEG)

Running Programs on the Comet Supercomputer

- The first segment included an introduction to parallel computing which including learning about supercomputers, distributed and shared computing
- We then were able to access the Comet supercomputer through the application PuTTY where we used UNIX to send out scripts to the Comet supercomputer to carry out.
- After getting familiar with UNIX and learning the basics of C, we then sent some SLURM scripts to the Comet supercomputer to test the effects to the time by adding more nodes.
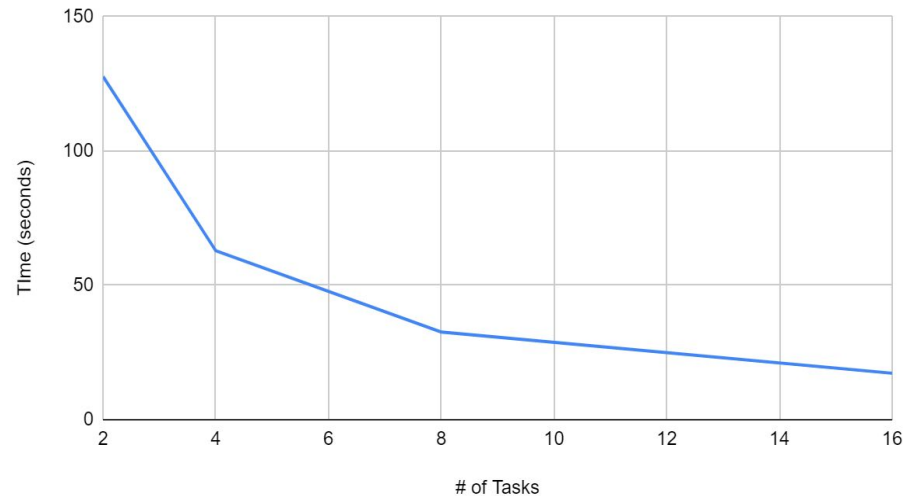
8000 x 8000 Matrix Multiplication on Comet supercomputer at SDSC (OpenMP and MPI)

OpenMP

Time (seconds) vs # of Threads
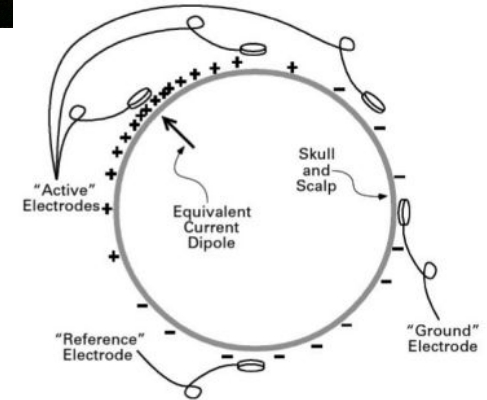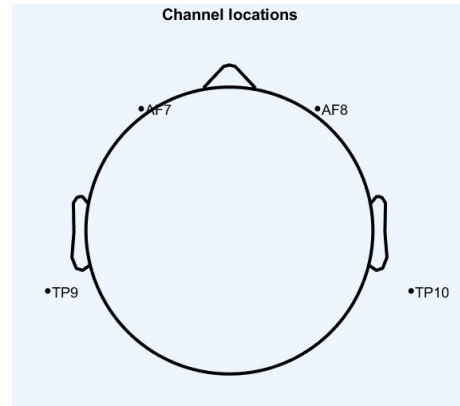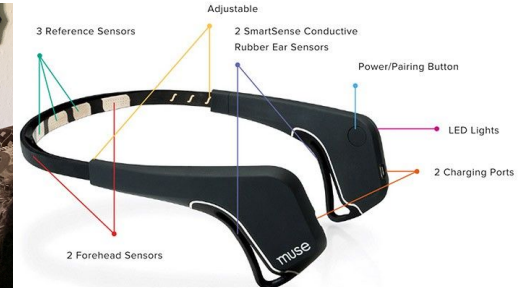
MPI

TIme (seconds) vs # of Tasks
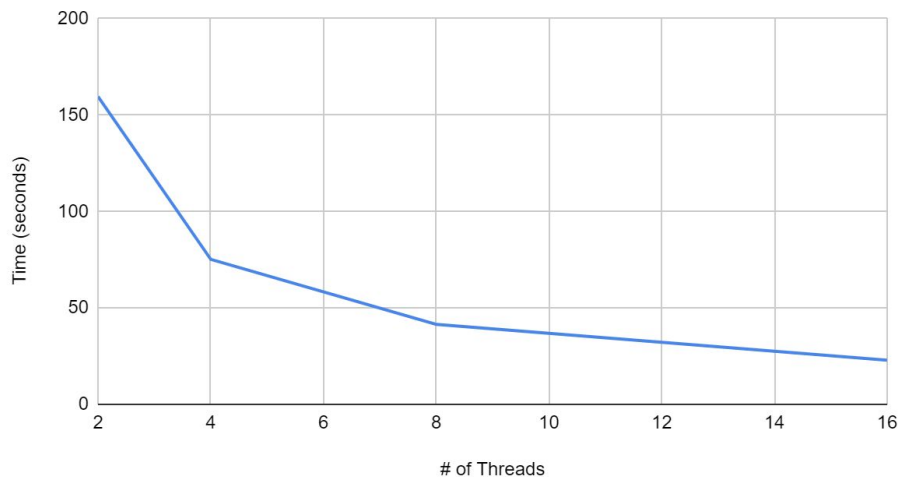
Intro to EEG and the Muse headset

What is EEG?

- A Measure of the brain's electrical activity through the use of scalp electrodes

Muse headset

- Has 4 electrodes that sense brain activity
- Tricky to monitor

Adjustable
3 Reference Sensors
2 SmartSense Conductive Rubber Ear Sensors
Power/Pairing Button
LED Lights
2 Charging Ports
2 Forehead Sensors

Channel locations

•AF7   •AF8

•TP9   •TP10

"Active" Electrodes
Skull and Scalp
Equivalent Current Dipole
"Reference" Electrode
"Ground" Electrode

Luck, Steven J.. An Introduction to the Event-Related Potential Technique, MIT Press, 2014

Experiment

- Record data using muse headband and mind monitor app
- Use EEGLAB, which is a toolbox on MATLAB, to inspect and analyze data.
- EEGLAB allows the data inputted to go through artifact rejection, averaging , as well as multiple methods of visualization.
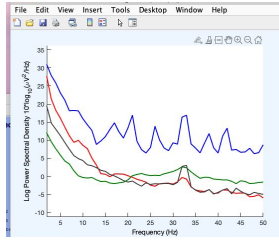
Data

- 3-5 minutes with eyes open
- 3-5 minutes with eyes closed

Goal

- Record accurate data
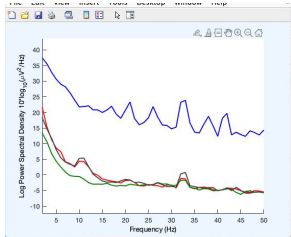- See a physiological difference between two mental states in the data
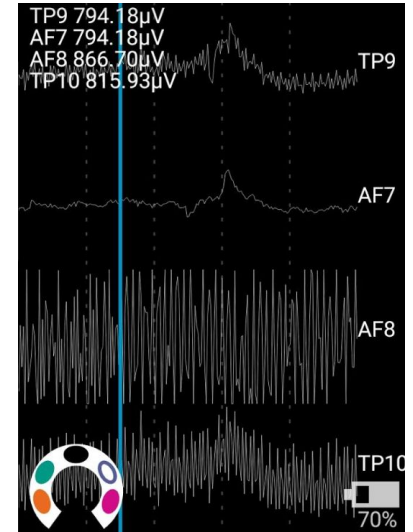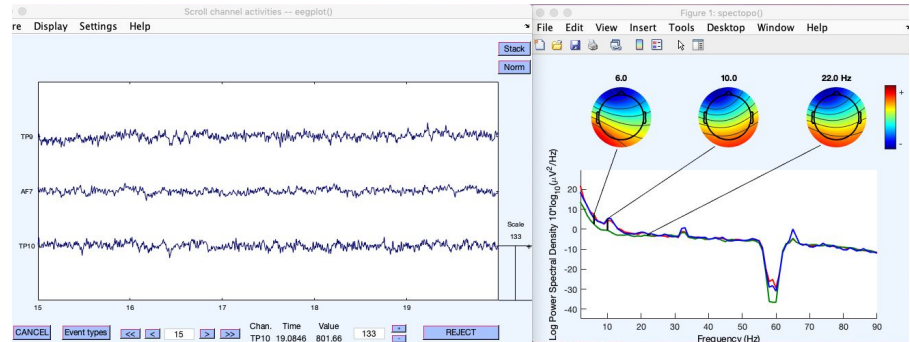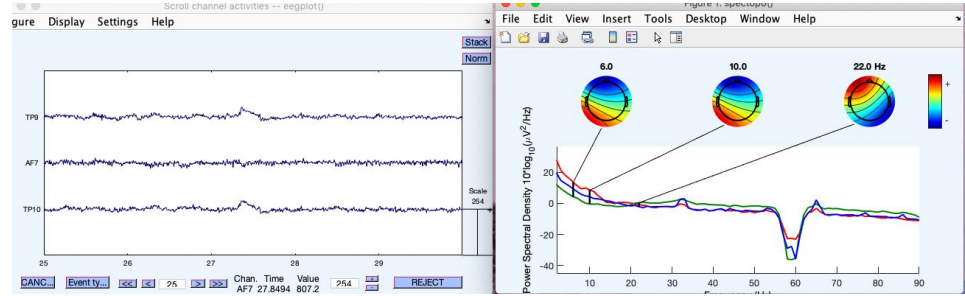
Filtered Plots and Spectral Maps (Subject 1)

Eyes Open

Some data was taken out in order for it to be comparable.
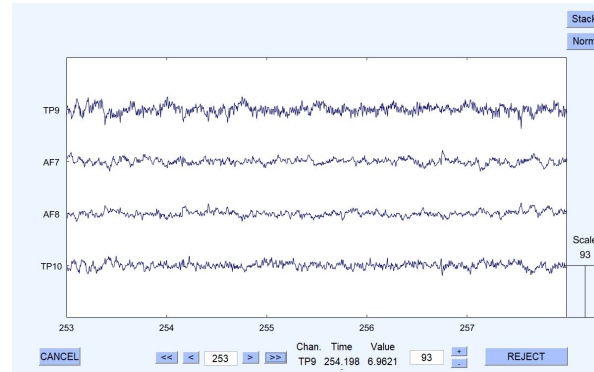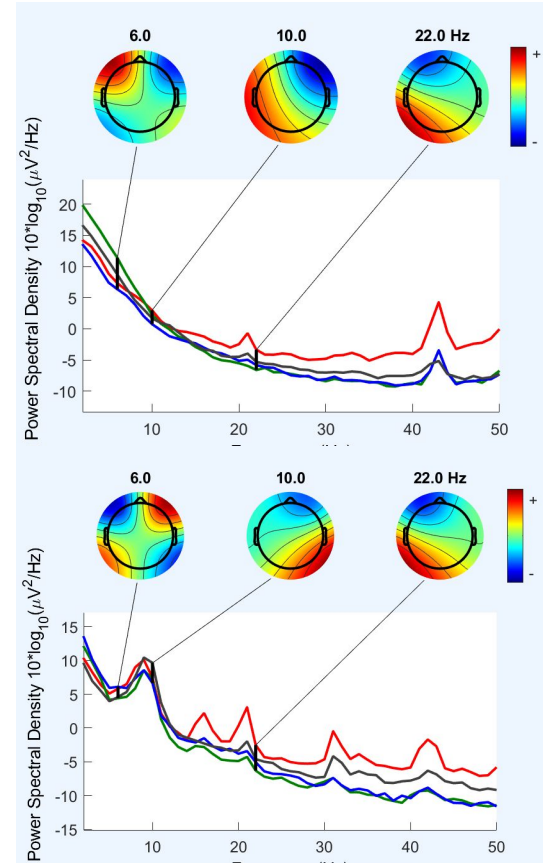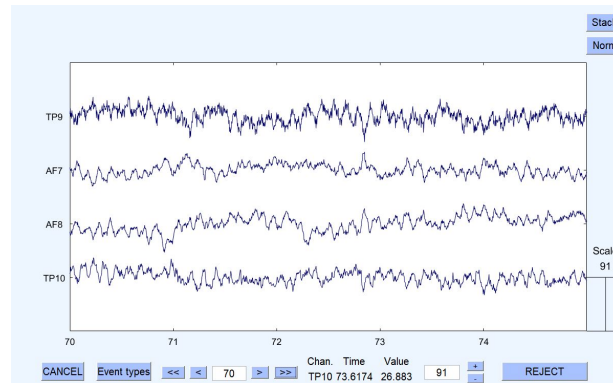
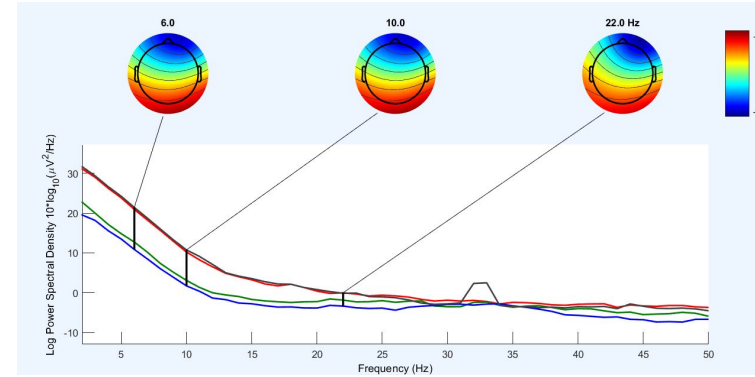Eyes Closed

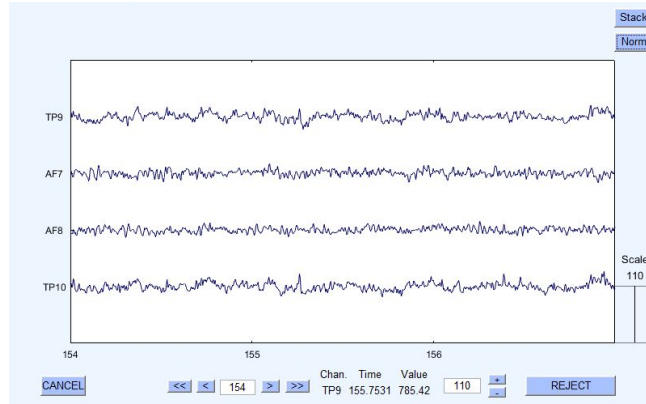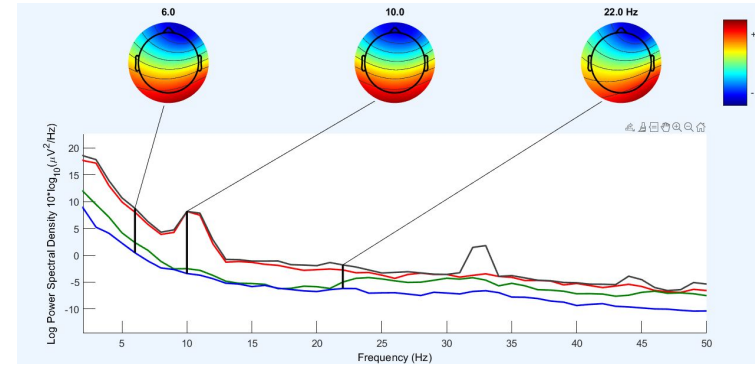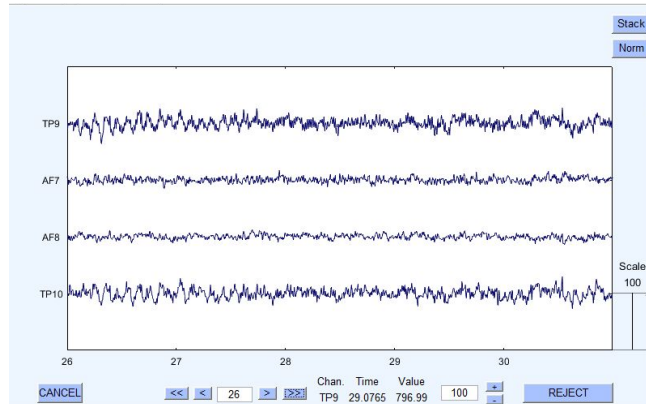# Filtered Plots and Spectral Maps (Subject 2)

Eyes Open

Eyes Closed

Filtered plots and spectral Maps (subject 3)

Eyes open

Eyes closed

Conclusion

- There is a peak around 8-12 hertz when eyes are closed. This falls within the Alpha band oscillations of the brain, which indicates a feeling of relaxation.