Signal Processing Applied to Neuroscience

Tutorial Prepared by Taylor Baum for the 2022 Quantitative Methods Workshop

# Summary

In this tutorial, we will explore signals from the brain known as steady state visually evoked potentials (SSVEP).

The goal of this workshop is to do the following:

1. **Familiarize** you with a commonly used non-invasive brain signal acquisition device called an **Electroencephologram (EEG).**
2. **Familiarize** you with a signal commonly used in brain computer interfaces, **Steady State Visually Evoked Potentials (SSVEP).**
3. Get an abstract understanding of **Signal Processing** and **Frequency Analysis.**
   1. Understand the application and usefulness of these techniques in analyzing EEG signals.
   2. Move through the process of implementing these techniques in Python3.

# Prework

In the prework, you should get familiar with the data set that we will be using. The paper attached is the paper that was published alone with the open source data set that we will be using.

Please complete the following tasks for Jan 5, 2022:

1. Read [Zhu2021.pdf](https://drive.google.com/file/d/1_vCOCao3aY8dHFO9fb45-HXVxxu6nN-R/view?usp=sharing).
2. Watch [Steady state visual evoked potential (SSVEP) based brain-computer interface (BCI) performance under](https://www.youtube.com/watch?v=t96rl1SFHlI) to get a better understanding of what an SSVEP signal is.

# Tutorial

**Slides**: [EEG-SSVEP-Slides.pptx](https://docs.google.com/presentation/d/122eqNYKoP4uhtxlEhOono3hVYL0vrqhx/edit?usp=sharing&ouid=108168531769095699144&rtpof=true&sd=true)

**Google Colab Tutorial**: [Signal Processing Applied to Neuroscience Tutorial](https://drive.google.com/file/d/1ZN1pTur2e_sN96UJIeWlifuuOZaGE77h/view?usp=sharing)

**Google Colab Tutorial Solutions**: [Solutions](https://drive.google.com/file/d/1S1w5eFe51a0inhQ4n1iLMQh5QF3g9p99/view?usp=sharing)

# References

1. [SSVEP Open Source Data Set](http://bci.med.tsinghua.edu.cn/download.html)