Task 1: Setup Python 3

All Tasks will use Python 3 including a variety of packages. Install Anaconda to get started. Anaconda is a package manager and comes with Python 3.7 and some useful additional packages:

Anaconda Python: https://www.anaconda.com/distribution/

Test your installation of Anaconda and Python

1. Test your installation by entering in a command line: `conda list`
    a. All installed packages should be shown
2. Enter in a command line: `python`
    a. You should see your Python version, ignore the warning about environment activation for now (if you use "Anaconda Prompt" you will not see the warning)
3. Leave python by entering: `quit()`

We will also need the package `mne` for processing. You can install it via pip or conda.

4. Open a command line
5. Use `pip install mne` or `conda install mne`
6. Open the python interpreter by entering in a command line: `python`
7. Now import the OpenCV library by entering: `import mne`

If this does not throw an error, you have successfully installed mne.
You now have a running version of Python 3.7 using Anaconda as package manager and mne for signal processing.

Task 2: Numpy and Matplotlib

Task 3 introduces basic data wrangling using numpy and plotting with matplotlib. Therefore, each library need to imported. Imports in Python are done by:

```
import <library name>
```

Start your python script by importing numpy as np:

```
import numpy as np
```

You now have access to a wide range of scientific function. For an overview see:
https://www.numpy.org/

Task 2.1 Arrays and numpy

Initialize two arrays *Input* and *Output*:

1. *Input* includes 5 numbers
2. *Output* is empty

Your task is to divide all values of *Input* by a number of your choice. Save the result in *Output.*
Now Convert *Input* into a NumPy array and divide the array by a number of your choice. What are the main differences in the syntax?

Task 2.2 Plotting waves with Matplotlib

In this task, you will create and plot sine waves. Experiment with the parameters to gain an understanding of how they influence the wave.
Hint: The following procedure may be helpful for this task:

1. Import numpy and pyplot from matplotlib with a name of your choice
2. Generate an array 1000 evenly spaced values between 0 and 30 using linspace from numpy
3. Use this array to generate a sine wave with numpy
4. Plot both waves with different colours and label in ONE graph using matplotlib imported before
5. Adjust the limits of the graph and position of the legend
6. Save the plot as png

Task 2.3 Calculating a fast Fourier transform

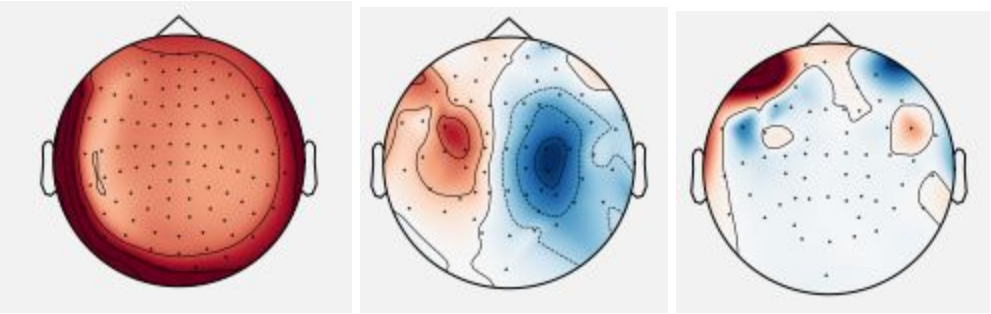
Apply a fast Fourier transform (FFT) on your sine wave. A FFT calculates the power of frequencies of a signal. You can use the `scipy` package to accomplish this. You can also plot the results using matplotlib.

Task 3: Power Spectral Density of a Signal

Python MNE is a library that is used to analyze physiological signals. Follow and understand code examples in the code folder. You can download and run them on your computer using jupyter notebooks.

Task 4: Independent Component Analysis

An ICA provides you the following components:



(A) **(B)** **(C)**

Which of the components would you reject? Which one would you keep? Provide an explanation for each of your choices.

Task 4: Event-Related Potentials

Task 4.1: P300 and N400

Describe in your own words what event-related potentials (ERPs) are. Explain the semantics of the P300 and N400 in your own words.

Task 4.2: Calculating ERPs

Follow the tutorial in the “code” folder and understand how ERPs are calculated. How does the rejection threshold values in cell [11] influence the overall result?