EEG signals Peak detection and Machine Learning Problem Statements

Task 1: SSVEP
During the SSVEP paradigm the subject is exposed to a checkerboard where the possible destination tiles of a chess piece
are flickering at different frequencies. The subject is asked to focus on the flickering tile where the chess piece
should move to.

Event ids of interest
- 100: ssvep stimuli start, tiles flicker for 5 seconds
- 1: 7.5 Hz flicker active
- 2: 8.57 Hz flicker active
- 3: 10 Hz flicker active
- 4: 12 Hz flicker active
- 1001: User confirmed 7.5 Hz flicker as focused target
- 1002: User confirmed 8.57 Hz flicker as focused target
- 1003: User confirmed 10 Hz flicker as focused target
- 1004: User confirmed 12 Hz flicker as focused target
- 999: User confirmed no flicker as focused target

Example flow:

100 -> 1, 2 -> 1001
SSVEP stared -> Tiles are flickering with 7.5 Hz and 8.57 Hz -> User confirmed 7.5 Hz as focused target

100 -> 3, 4 -> 1003
SSVEP stared -> Tiles are flickering with 10 Hz and 12 Hz -> User confirmed 10 Hz as focused target

100 -> 1, 2, 3, 4 -> 999
SSVEP stared -> Tiles are flickering with 7.5 Hz, 8.57 Hz, 10 Hz and 12 Hz -> User confirmed no flicker as focused target

Develop a code to preprocess EEG signals, extract features and perform classification using a linear machine learning classifier and deep learning model.

Task 2: P300
The subject is steering a character on the screen and is asked to avoid objects in red that deduct points and collect
objects in green that add points.

Event ids of interest
- 2: odd stimuli (subject sees odd stimuli)
- 1: std stimuli (subject sees std stimuli)

Develop a code to preprocess EEG signals and find amplitudes and latencies for the P300 peak.

Task 3: VEP
During the stimulation the subject is exposed to a checkerboard pattern that flickers at 15 Hz. The subject is asked to
focus in the center of the screen.

Event ids of interest
- 3: vep stimuli (frame update)

Develop a code to preprocess EEG signals and find amplitudes and latencies for the VEP peak.

Task 4: EMG
The experiment involved 10 subject and each subject was asked to perform 3 exercises; shoulder flexion (SF), shoulder abduction (SA) and elbow extension (EE). Each subject was asked to perform 3 repetitions of each exercise. Hence, the total number of CSV files are 10X3X3.
Each CSV file consists of 3 columns :
– Time
– EMG Raw data
– label : 0=NO FATIGUE, 1=FATIGUE

Develop a code to preprocess EMG signals, extract features and perform classification using a linear machine learning classifier and deep learning model.