Description:

This code package is intended to use within targeted datasets and is partially under manual supervision. All scripts are made to be toggled on/off to process a specific case of data analysis. The package consists of 3 scripts and the rest are functions:

- *mainanalysis_dataset1:* is used for analysing dataset 1
- *mainanalysis_dataset2:* is used for analysing dataset 2
- *mainanalysis_dataset3:* is used for analysing dataset 3
- *eeg_filter:* perform notch filter and band-pass filter
- *CSP_training:* perform Common Spatial Pattern
- *FBCSP_training:* perform Filter Bank Common Spatial Pattern
- *DFBCSP_training_Fisher:* perform Discriminative Filter Bank Common Spatial Pattern with the Fisher's criteria
- *DFBCSP_training_mRmR:* perform Discriminative Filter Bank Common Spatial Pattern incorporated with the minimum-redundancy-maximum-relevance algorithm
- *DFBCSP_training_FmRmR:* perform Discriminative Filter Bank Common Spatial Pattern incorporated with the combination of Fisher's criteria and minimum-redundancy-maximum-relevance algorithm

Step-by-step guide:

1. *Download the right datasets:* Dataset 1 (BCI Competition IV dataset 2a) and Dataset 2 and 3 (contact authors for further information)

2. *Open the right script:* run MATLAB (2018 or later) and open the right script for analysing the intended dataset.

3. *Initial Checks:* check the `%%CONFIG` section to see if the sampling rate (**fs**), the number of folds (**FOLD**) for cross-validation, and the subject ID (**idname**, only applicable for Dataset 2) are correct. For Dataset 2, the subject ID has to be changed according to the subject's folder in the dataset before running.

4. *Toggling on/off in Pre-processing:* Let's jump to `%%PREPROCESSING`, which has 4 subsections **(**`%%1-s segment, %%1-second overlapping 0.5-second, %%2-second overlapping 1-second, %%Whole segment`**)**. Each of these subsections corresponds to each time segment type mentioned in the study. There are 2 steps to toggle on/off (comment/uncomment) the case:
    a. *First toggling:* comment/uncomment (CTRL + R or CTRL + T) all lines in a specific subsection to select/unselect the case.
    b. *Second toggling:* If the feature extraction method used is CSP, comment the Case 01 and uncomment Case 02, and vice versa.

5. *Toggling on/off in Feature Extracting:* Let's jump to `%%FEATURE EXTRACTION`, which has 5 subsections (`%%CSP`, `%%FBCSP`, `%%DFBCSP Fisher`, `%%DFBCSP mRmR`, `%%DFBCSP FmRmR`). Each of these subsections corresponds to each feature extraction method mentioned in the study. Likewise, uncomment the intended subsection and comment other subsections. **Please note:** If the feature extraction method used is CSP, comment the Case 01 and uncomment Case 02 (in `%%PREPROCESSING`), and vice versa.

6. *Press Run:* Carefully check all parameters and sections (`%%CONFIG`, `%%PREPROCESSING`, `%%FEATURE EXTRACTION`) and Press Run to start the analysis. A pop-up window would appear and it requires the user to pick the location of data. **Please note:**
    a. *For Dataset 1:* Locate the folder of the targeted subject and select the correct *.mat file to be analysed.
    b. *For Dataset 2:* Only need to assign the correct path to the dataset folder, where the user can see the list of all subjects. DON'T go into a specific folder.
    c. *For Dataset 3:* Assign the correct path to the specific subject's folder.

7. *Results:* would be displayed on Command Window as well as stored as a **"final_result_subjectID.mat"** data file. Different feature extraction methods can be stored in the same result output file, not applicable for different time segments.