The American University in Cairo
Computer Science and Engineering Department
Spring 2024

THE AMERICAN UNIVERSITY IN CAIRO

CSCE 363/3611 – Digital Signal Processing

Project

(Due on: May 19, 2024 at mid-night)
(Submit on Blackboard as one .zip file)

Implement the approach explained in Slide 14 in the attached file "Motor Imagery.pdf". Data of 3 different subjects is provided. For each subject, you will find 3 files as follows:

- SubjectX_Signals.csv: Each column represents the signal recorded for one EEG electrode. Total number of electrodes is 15.
- SubjectX_Labels.csv: Each value represents the class label (1 for moving right hand or 2 for moving feet)
- SubjectX_Trial.csv: Each value represents the sample number at which a trial starts.

The sampling rate of the data is 512Hz.

Deliverables:

- Your code
- Plot the spectrum of each of the first 3 channels for Subject 1 before applying the Common Average Reference (CAR) filter and after applying it.
- Based on the plots, comment on the impact of the CAR filter on the recorded data.
- For each of the 3 subjects, identify the electrode, band and value of K that achieve the least 10-fold classification error. State the least error achieved in this case.
- Comment on the differences across subjects. Is there a difference in the best electrode, band and value of K identified across subjects?
- By averaging across the 3 subjects, identify the electrode, band and value of K that achieve the least 10-fold classification error. State the least error achieved in this case.
- What is the least error achieved for each subject if the concatenation of all electrodes and bands is used as input to the KNN classifier?

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Submission:

- Your MATLAB or Python code to be submitted on Blackboard on **May 19 at mid-night**
- A report (to be submitted on Blackboard on **May 19 at mid-night**) that includes the following:
    - Description of the approach used
    - Outputs of the project as described in the deliverables
- Submission of the above items should be done as one .zip file by the deadline

Guidelines:

- This is a group project. A maximum of 3 students per group is allowed.
- Each team must send an e-mail by **Thursday, April 25 at mid-night** specifying the members of the team.
- **Changing teams will not be allowed**.
- Project evaluation will occur in the class of **May 20.**
- Project grading will be as follows (out of 15):
    - 5 points on the code submitted
    - 5 points on the submitted report
    - 5 points on the evaluation and discussion