

CSCI 490 Final Project

Paradigm Independent Classifier

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1. Project Objective

2. Methodology

i. Pre-processing

ii. Feature Extraction

iii. Paradigm Classifier

3. Results

4. Discussion

5. References

- Building a one-fits-all classifier for 8 classes coming from 3 paradigms – ERP, MI, SSVEP.

Raw Data : presented in [1]

Workplan:

1. Read the papers [1] and [2]
2. Preprocess the raw data
3. Extract the features for each paradigm
4. Implement classification
5. Evaluation of the model

Programming language – Python

Platforms – Google Collaboratory Notebooks

SSVEP

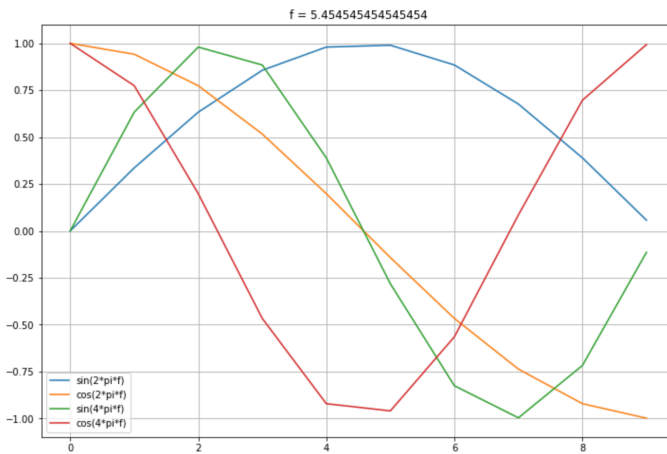
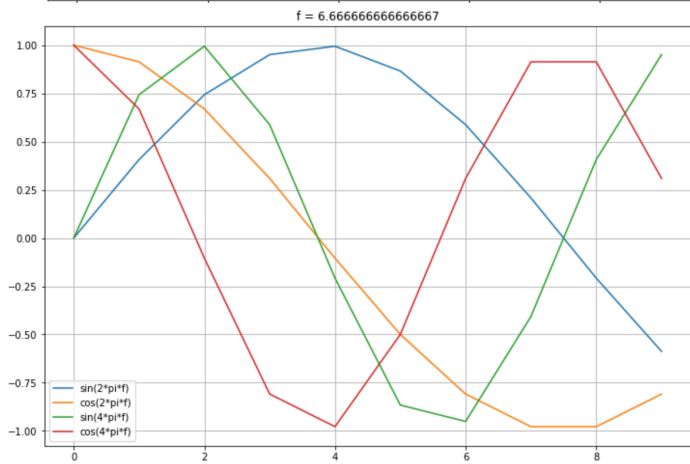
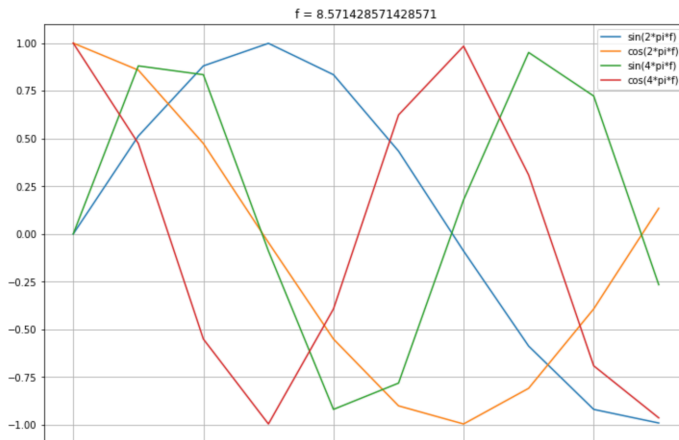
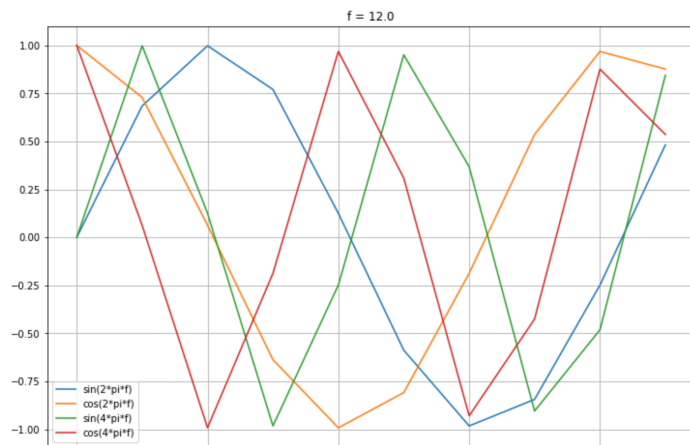
- Input Dim – x:1560080x62
(for train)
- Combine train and test splits
- Segment 0 to 4000ms
- Sampling frequency = 100 Hz
- Choose 10 channels
- Do CCA analysis
- Output Dim: 200x4
- src/ssvep.ipynb

ERP

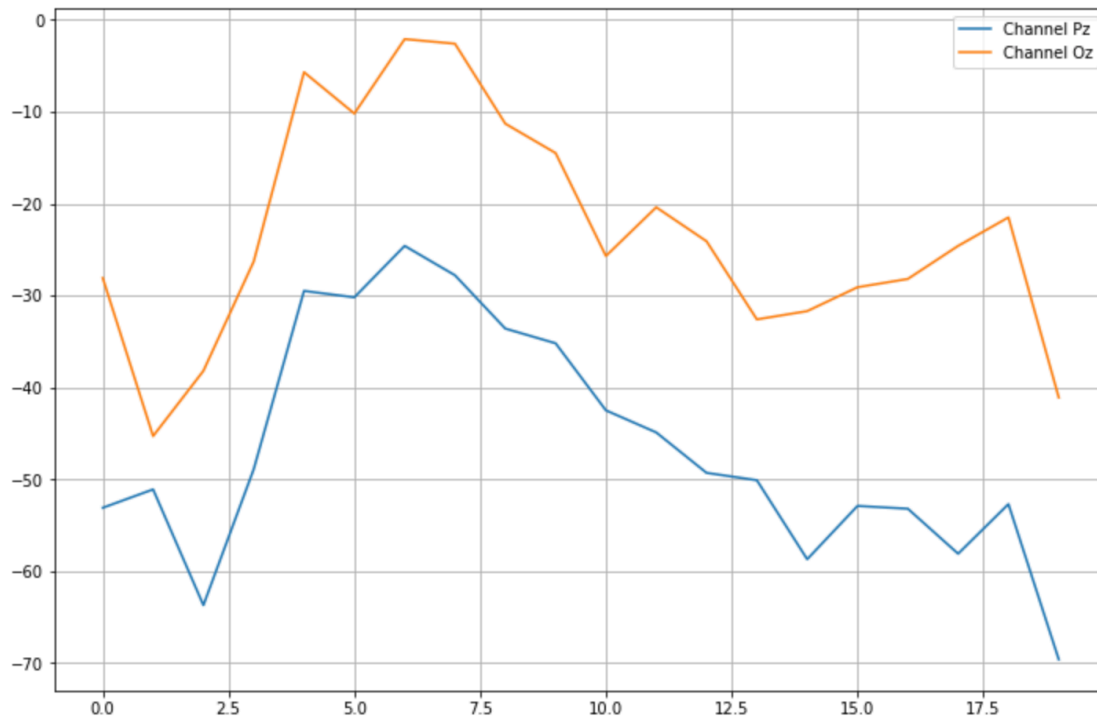
- Input Dim: 1005560x62
(for train)
- Segment -100 to 800ms
- Apply Band-pass filter
- Do baseline correction
- Averaging in 8 intervals
- Output Dim: (flatten)
200x6x16 = 200x96
- src/erp.ipynb

MI

- Input Dim: 1418040x62
(for train)
- Segment 0 to 4000ms
- Select channels
- Apply Band-pass filter
- Compute CSP
- Log-variance feature extraction
- Output Dim: 200x6
- src/mi.ipynb

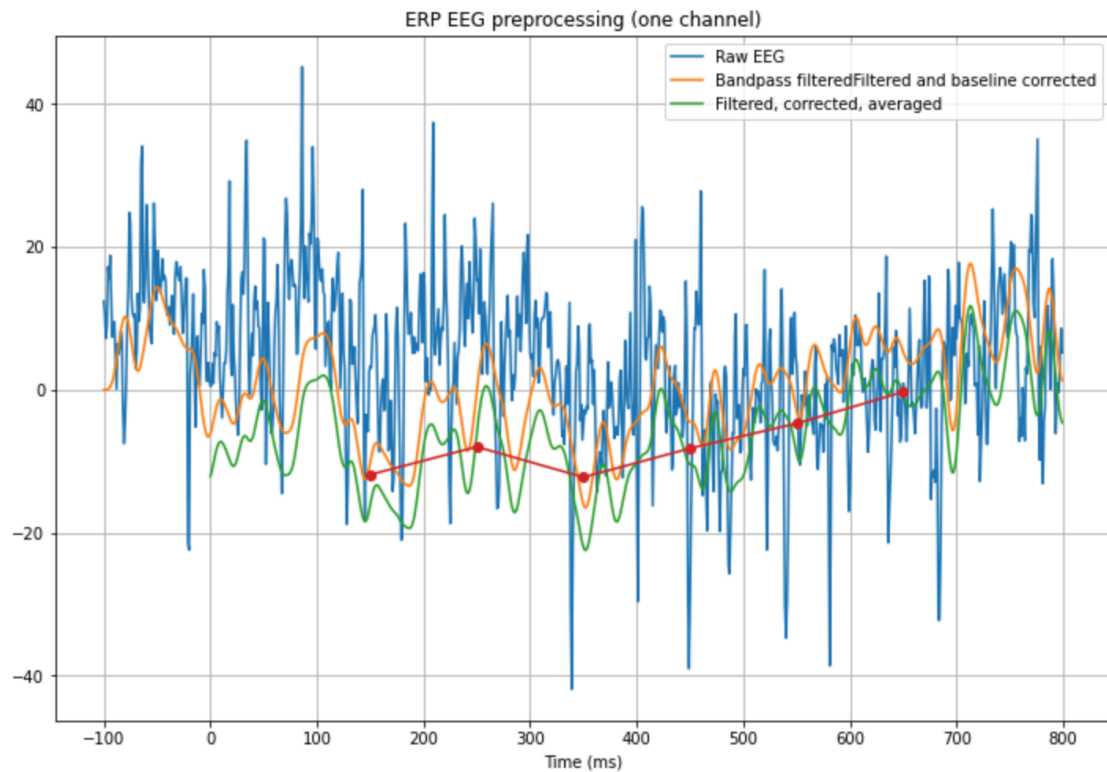


Session 1, Subject 1, SSVEP Trial 1



Result of SSVEP Preprocesssing: [0.19807767 0.32360884 0.17559054 0.24540942]

Output would be: 1



- Concatenate the data preprocessed for 3 paradigms
- Train classification on:
 - LDA
 - RLDA
- Compute 5-fold Cross-Validation
- main.ipynb

3. Results

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Subject #	RLDA Avg 5-CV Accuracy
Subject 1	0.635
Subject 2	0.7766666666666667
Subject 3	0.745
Subject 4	0.6950
Subject 5	0.768333
Subject 6	0.735
Subject 7	0.76
Subject 8	0.7
Subject 9	0.68333
Subject 10	0.755

- [1] Min-Ho Lee, O-Yeon Kwon, Yong-Jeong Kim, Hong-Kyung Kim, Young-Eun Lee, John Williamson, Siamac Fazli, and Seong-Whan Lee. Eeg dataset and openbmi toolbox for three bci paradigms: an investigation into bci illiteracy. *GigaScience*, 8(5):giz002, 2019.
- [2] Albina Li, Kanat Alimanov, Siamac Fazli, and Min-Ho Lee. Towards paradigm-independent brain computer interfaces. In *2020 8th International Winter Conference on Brain-Computer Interface (BCI)*, pages 1–6. IEEE, 2020.

**Thank you for
your attention!**

