Grasp-and-Lift EEG Detection

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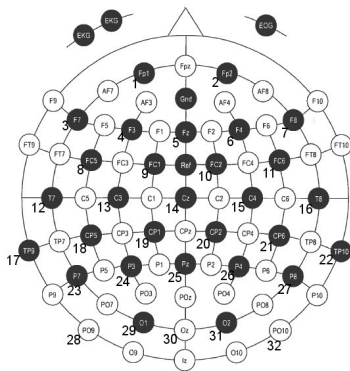# Project description

Identify hand motions from EEG recordings

- Goal: classify hand motions from its EEG signal data.
- Purpose: Brain-Computer Interface prosthetic devices for restoring a patient's ability to perform basic daily tasks.

Dataset

32 EEG signals:

- 30 Grasp And Lift series.
- Training data set: 96 files
- testing data set: 24 files
- Size: 1.5 Gb.
- 17985850 total number of samples
- $\sim 180k$ samples per subject
- sampling every: $0.2s$
- Multi class classification: *Hand start*, *First digit touch*, *Start load phase*, *lift off*, *Replace*, *Both released*

Evaluation Criteria

Mean Column-wise Area Under the
Curve (MCAUC): the mean of
individual areas under the ROC curve
for each predicted columns.

Sample ROC curve

Pipeline
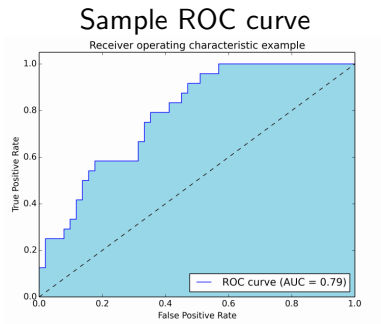
Preprocessing
KDawn Filter: with hyper parameter 2-3-4

VLAD
Number of clusters: $2^3 \rightarrow 2^{15}$

PCA
number of components $= 0.9$

SVM - Linear & Gaussian
C and γ varies from $2^{-3}$to 2^3

Performance optimization

- Preprocess: store the data for each component and use that in the next step of the pipeline
- VLAD: save intermediate states as bumpy binary files and use them for the other parts of the pipeline
- kmeans: inertia convergence criteria.

Pipeline Time

Total time $\sim 5h$

- Preprocessing: $< 1h$
- All other steps: $\sim 4h$

VLAD: $\sim 12s$ with 32 clusters and $0.5M$ local descriptors (with ubuntu dual core cpu, 3Gb ram)

SVM C	VLAD clusters	score
0.1	32	0.267
1	32	0.268
10	32	0.269

Table: N components=2

AUC

text

The End