

Epileptic Seizures Prediction

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Overview

Format :

Kaggle competition

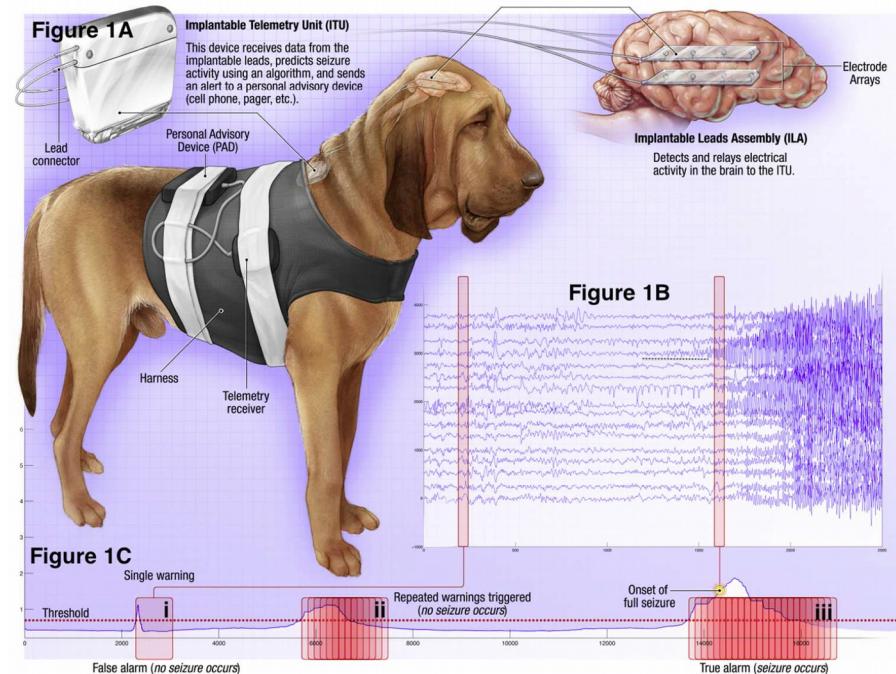
Goal :

Predict **epileptic seizure** onset

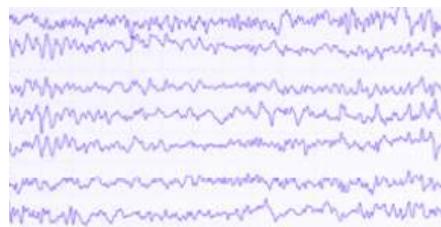
Data :

10 min **EEG** recordings

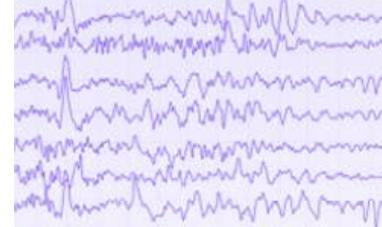
From **5 dogs / 2 patients**



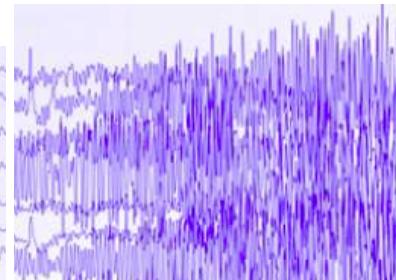
Overview



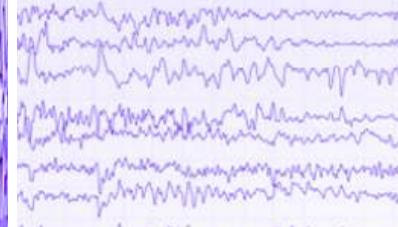
Interictal



Preictal



Ictal



Postictal

Time →

Data acquisition - data

.mat files to download

kaggle →



Fields :

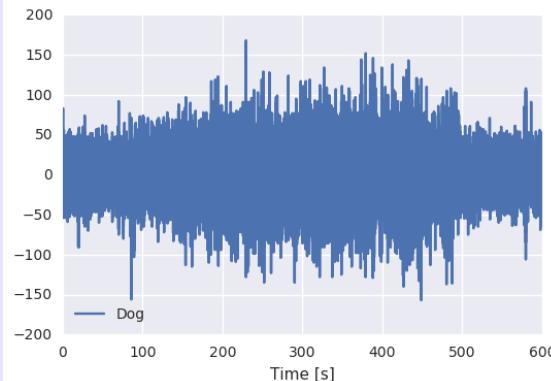
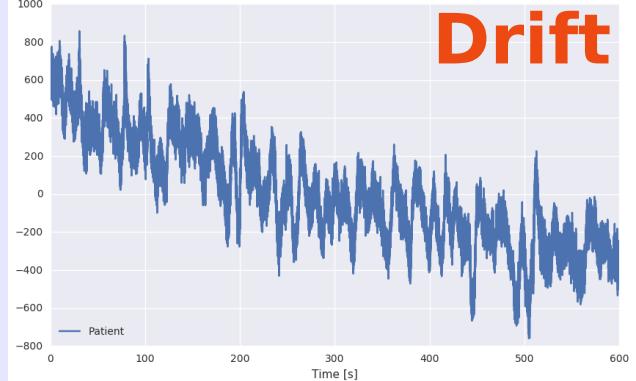
EEG recordings

Time duration [s]

Sampling freq. [Hz]

Channels ID

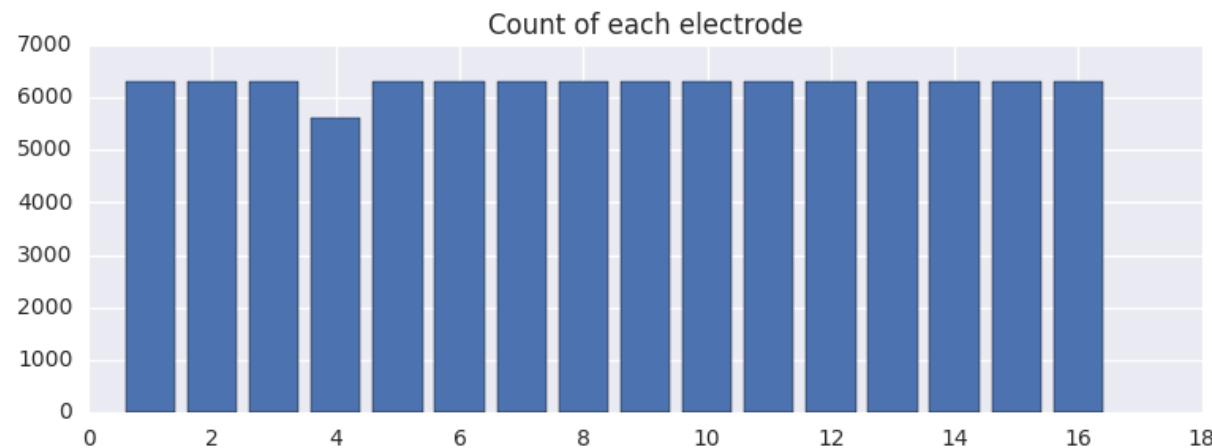
Data acquisition - cleaning

	Dogs	Patients
Implant stay	~ years	~ weeks
Electrode number	16	various
Referencing	Group avg.	Ref. electrode
Recording example	 A line graph showing a noisy signal for a dog over 600 seconds. The y-axis ranges from -200 to 200, and the x-axis ranges from 0 to 600 seconds. The signal is relatively stable around zero with high-frequency noise. Dog	 A line graph showing a noisy signal for a patient over 600 seconds. The y-axis ranges from -800 to 1000, and the x-axis ranges from 0 to 600 seconds. The signal shows a clear upward drift over time, with significant noise. Patient Drift

=> More processing needed
=> Discard Patients

Data exploration - channels

Total electrode count :



=> Electrode 4 absent from Dog_5

Data exploration - class repartition

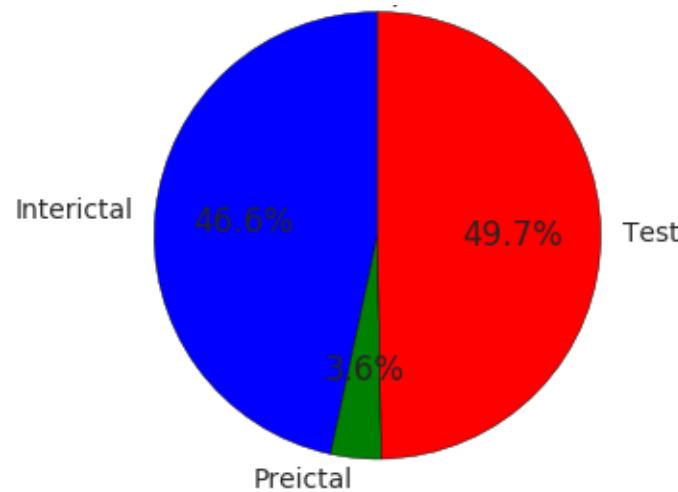
During competition :

Train model on **training set**

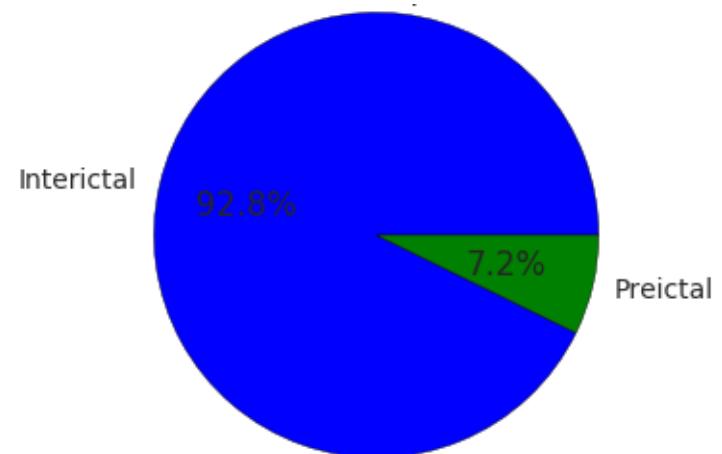
Ranking based on **test set** performance

Segment count:
Interictal: 2932
Preictal: 229
Test: 3127
Total: 6288

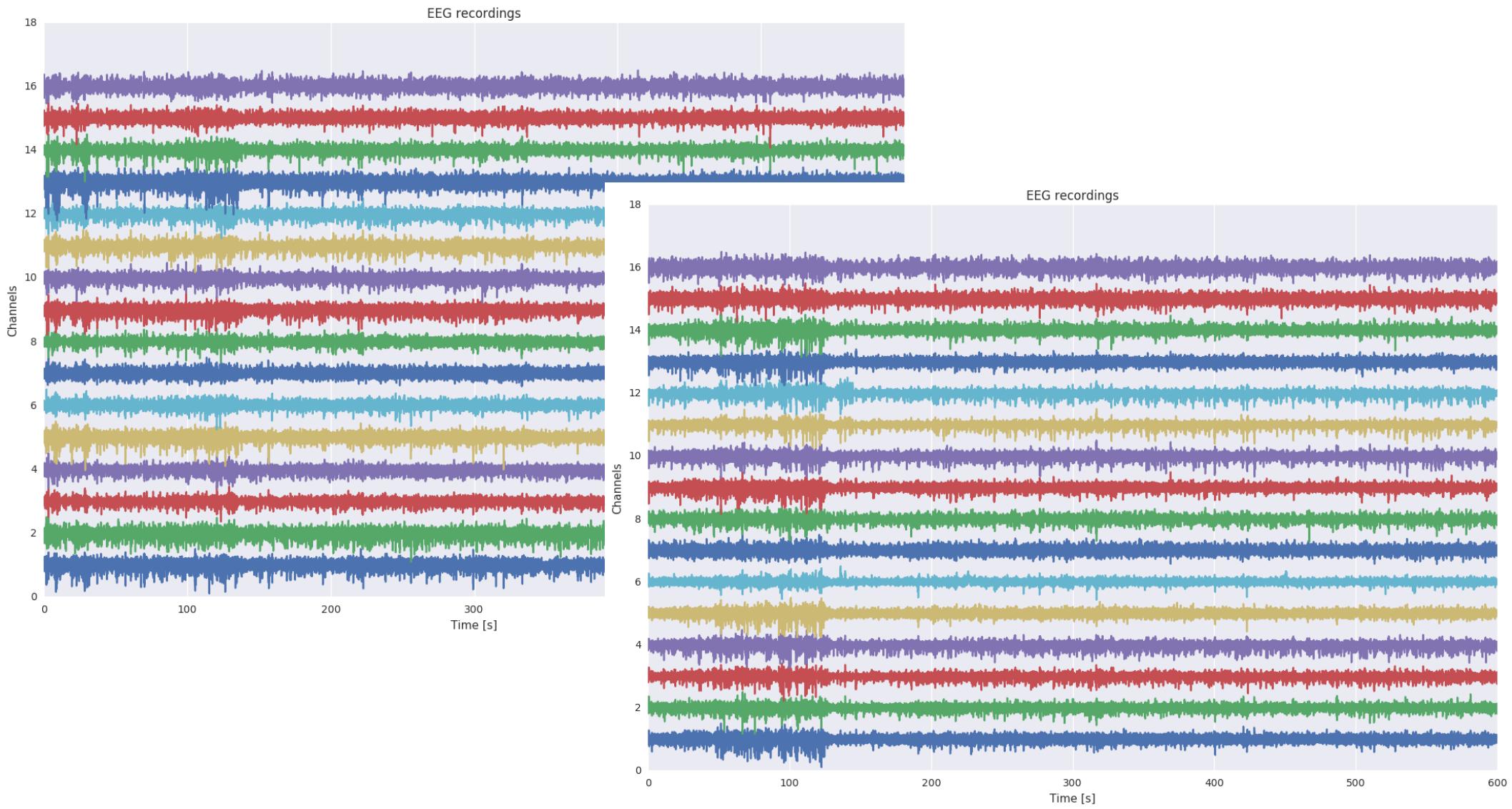
Total repartition



Train set repartition



Data exploration



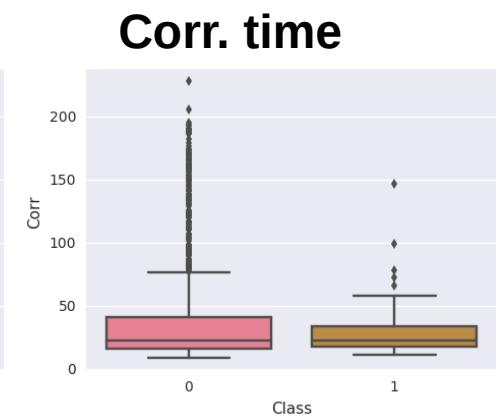
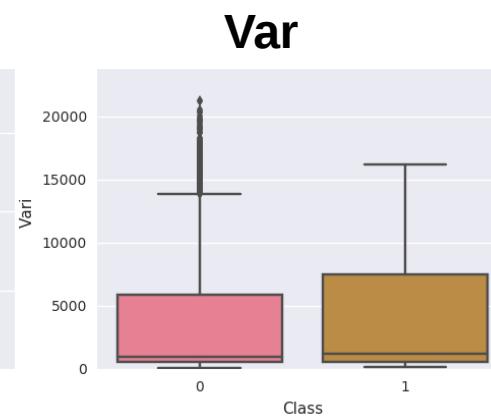
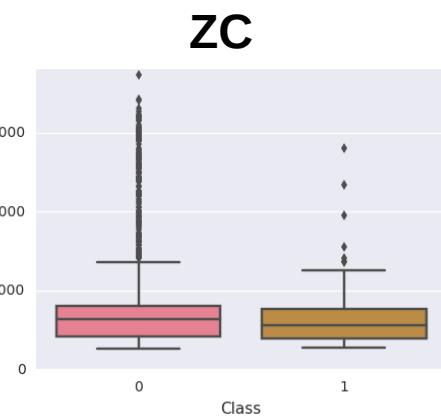
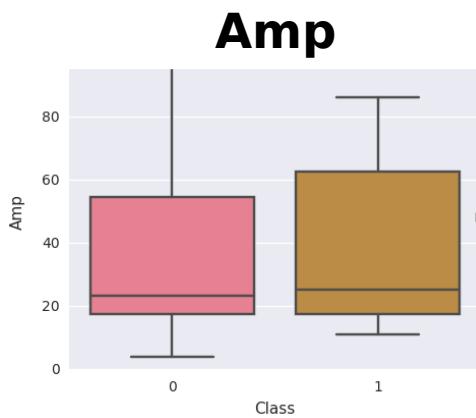
Data exploration - features

Amplitude

Zero-crossing

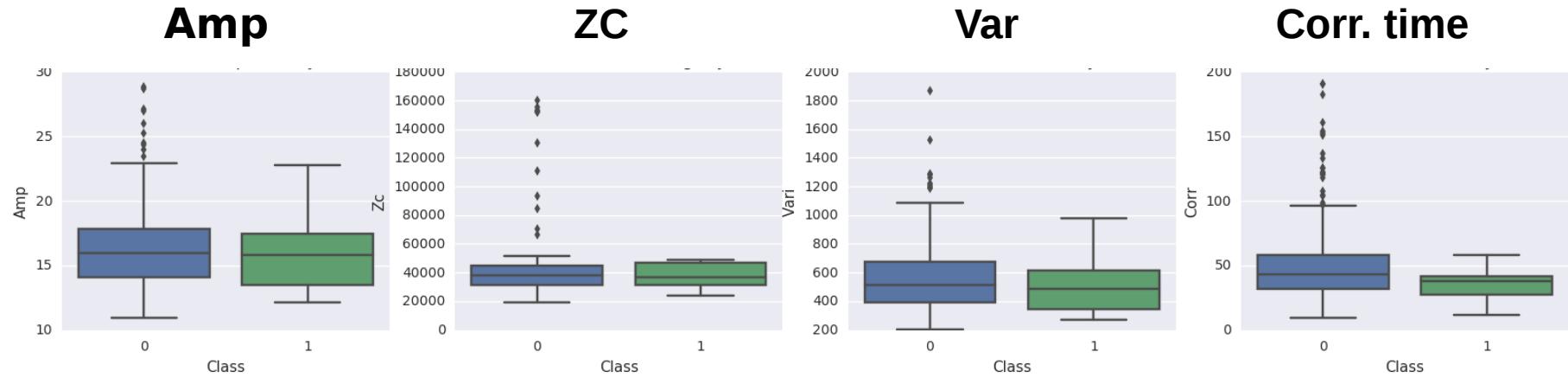
Variance

Correlation time

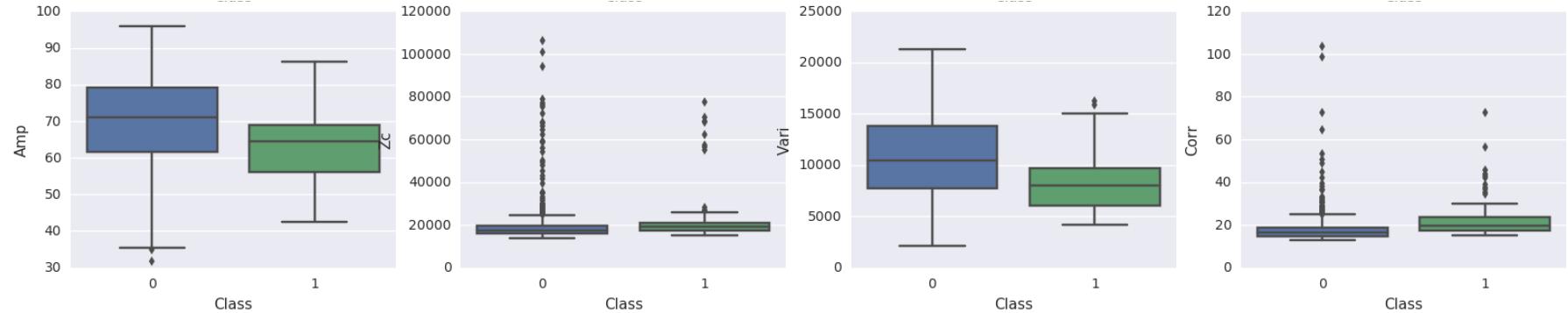


Data exploration - subject split

Dog_1



Dog_4



Data exploration - freq. bands

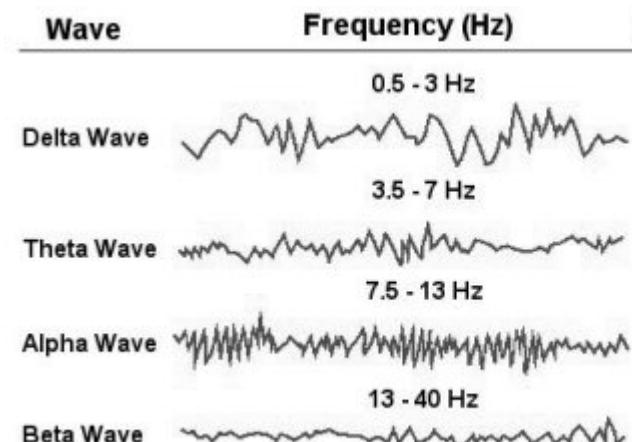
Neural oscillations :

Brain **electrical activity**

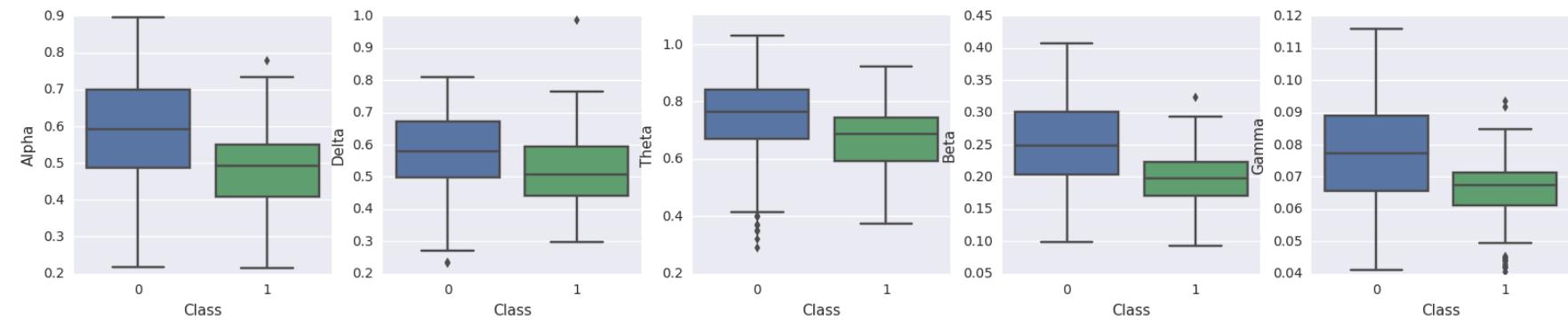
Spontaneous or stimuli response

Defined **frequency ranges**

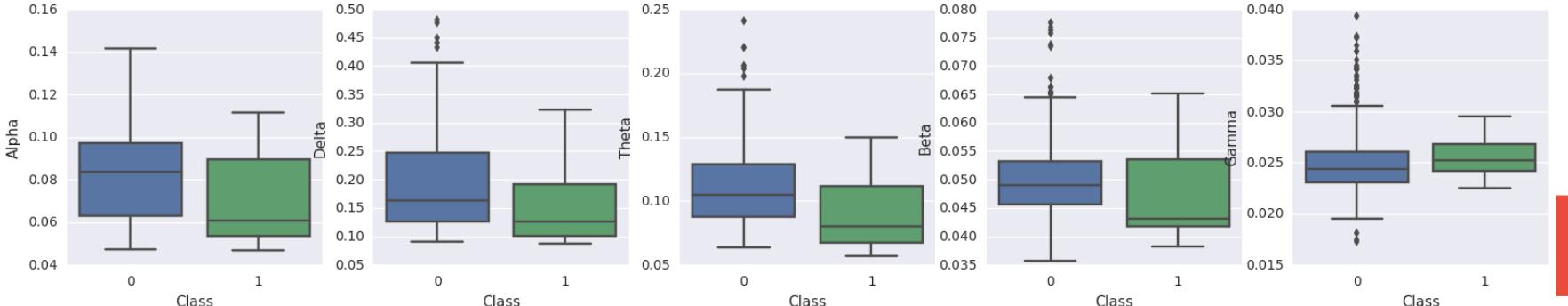
Can be **altered during seizures**



Dog_4



Dog_2



Data exploitation

Input features to classifiers

KNN, SVM, logistic regression, ...

Cross-validation

In average:

586 interictal segments

45 preictal segments

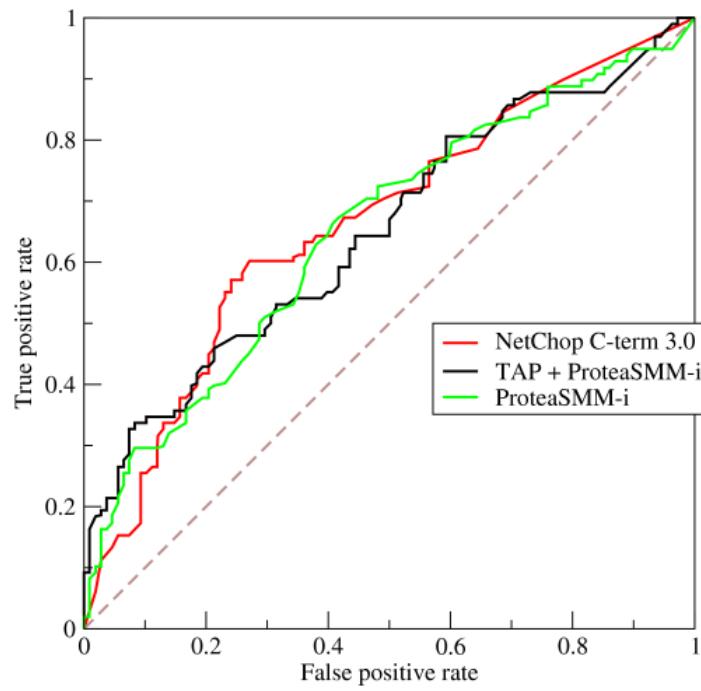
=> 2 folds

Select best classifier

Data exploitation

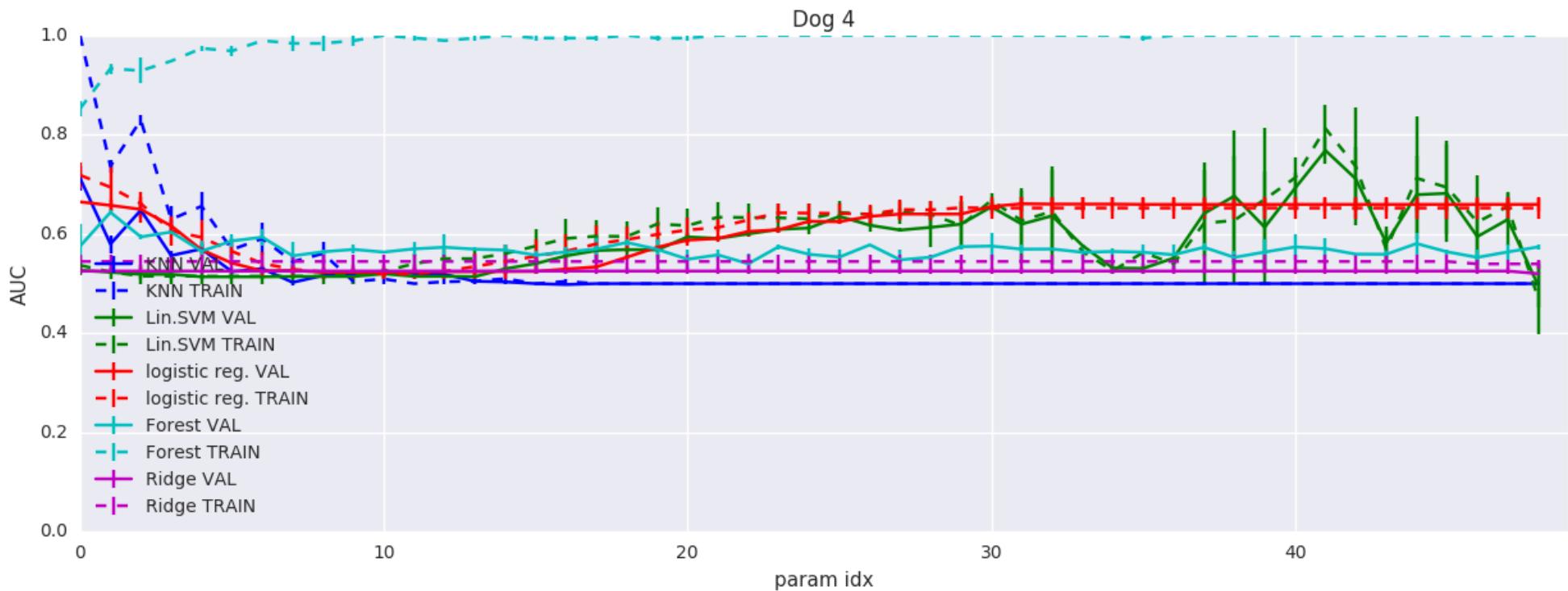
Performance evaluation :

Area Under the ROC Curve (AUC)



Data exploitation

Training results :



Data exploitation

Large number of features :

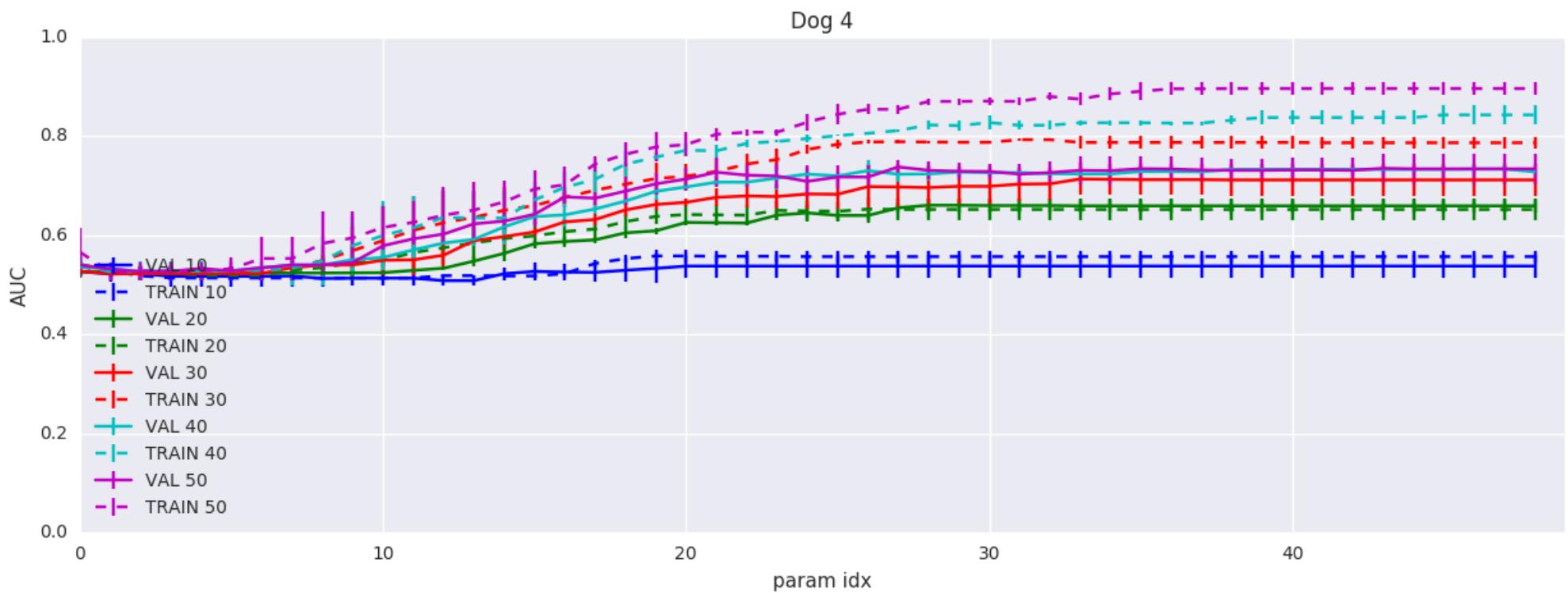
Statistics: $4 * 16 = 64$

Freq. Bands: $5 * 16 = 80$

=> Reduce dimensionality

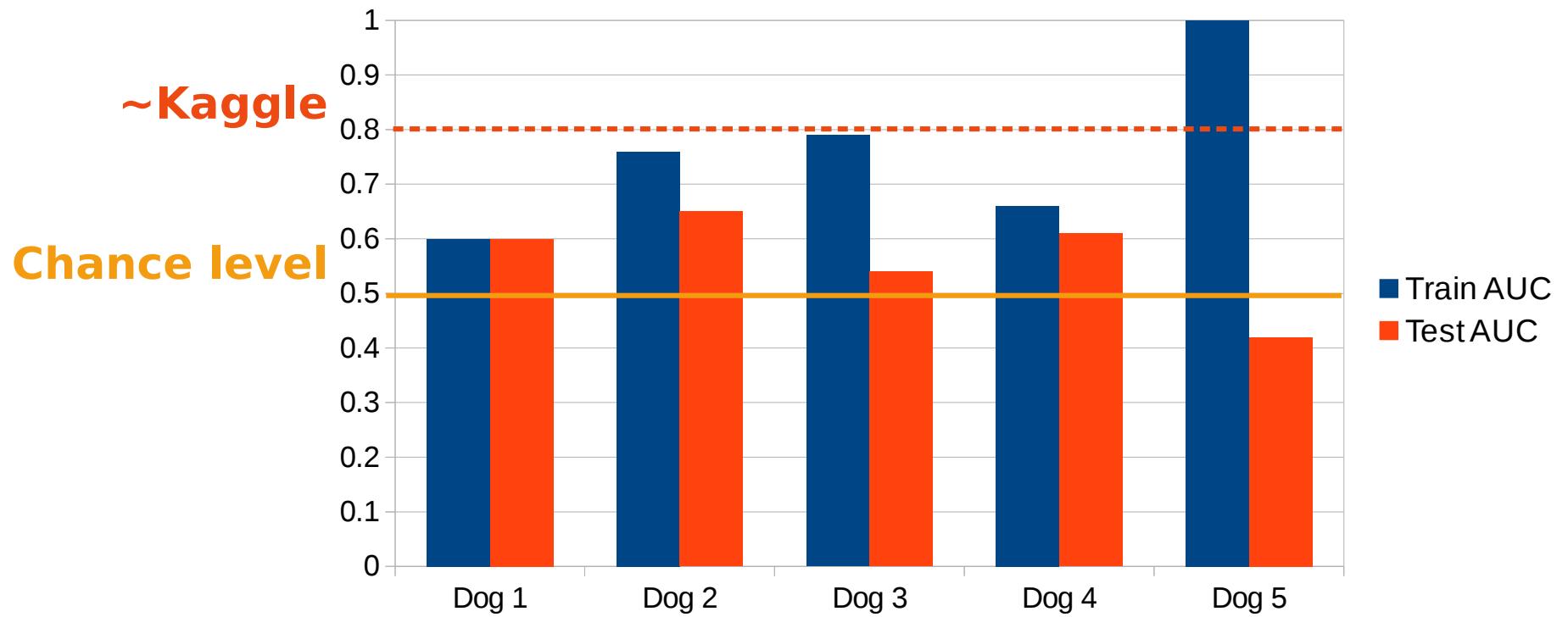
Data exploitation

Feature selection results



Evaluation

Test set performance



Other leads - same approach

New features ?

(AR modeling, wavelets, ...)

Different classifiers ?

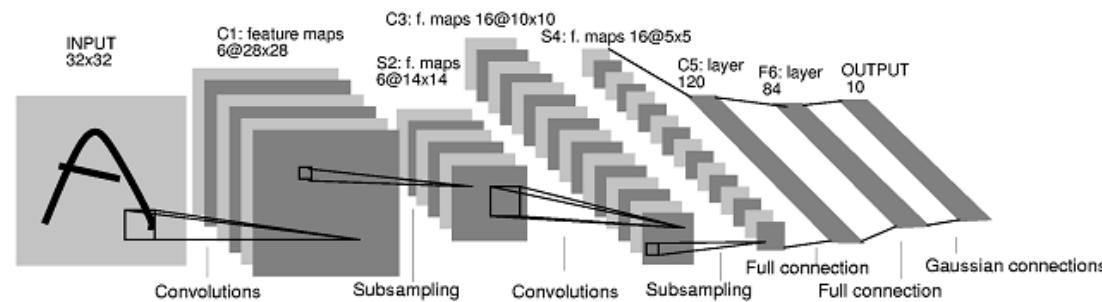
Better dimensionality reduction ?

(Sequential fs, PCA, ...)

Other leads - other approach

CNN

Similar to images,
but 1D filters



Signal on graph
Based on electrode locations

