

Predicting Seizures

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Conor Murphy

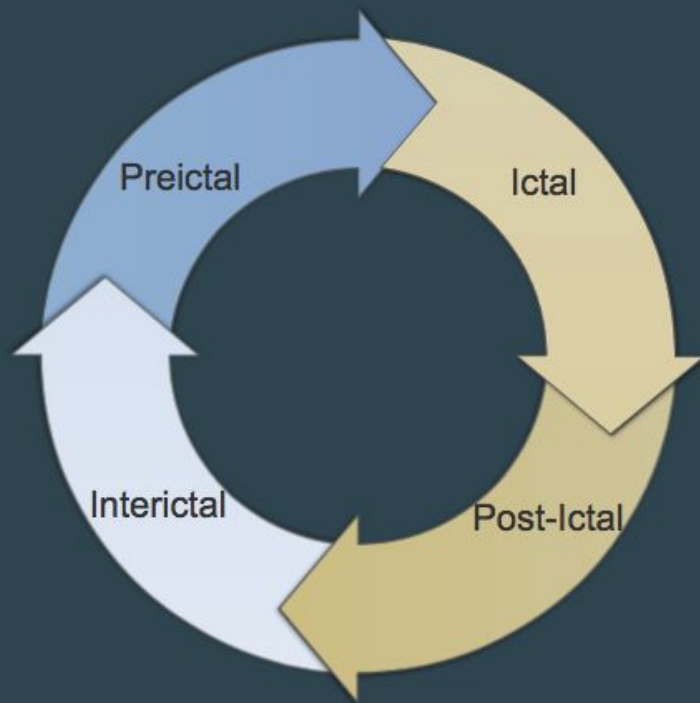
Lifecycle of Epilepsy

Interictal - Baseline/between seizures

Preictal - pre-seizure

Ictal - the seizure itself

Post-ictal - period after a seizure



Lifecycle of Epilepsy

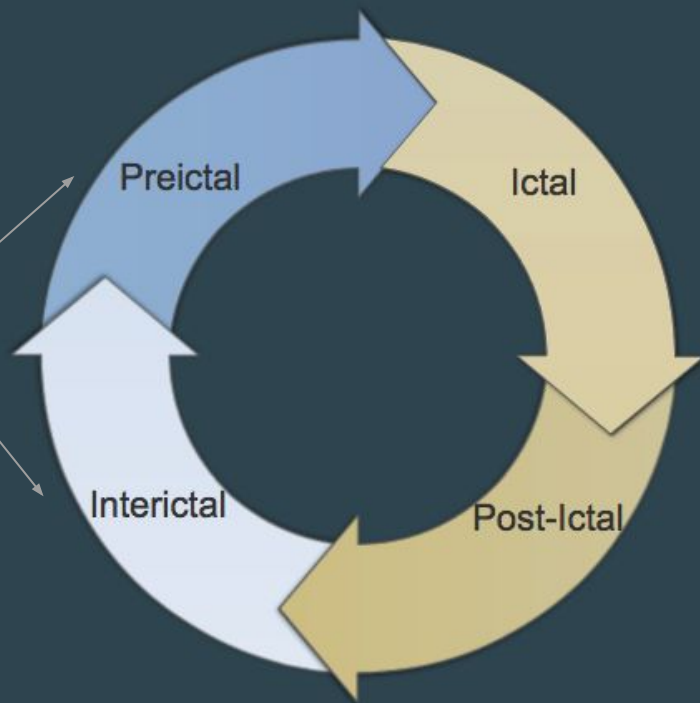
Interictal - Baseline/between seizures

Preictal - pre-seizure

Most difficult to classify

Ictal - the seizure itself

Post-ictal - period after a seizure



The Data

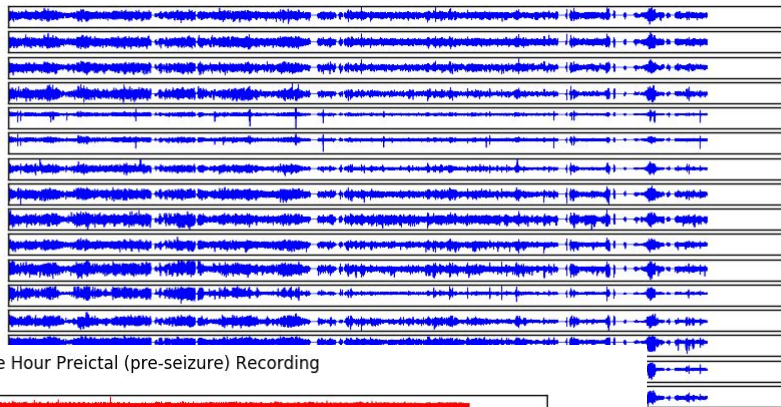
≈ 8k 10-minute iEEG recordings

Each recording 240k x 16

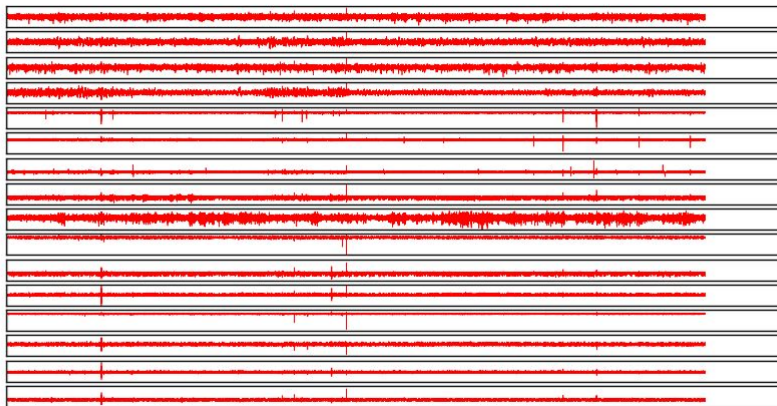
40 gb total data

EC2 m4.10xlarge

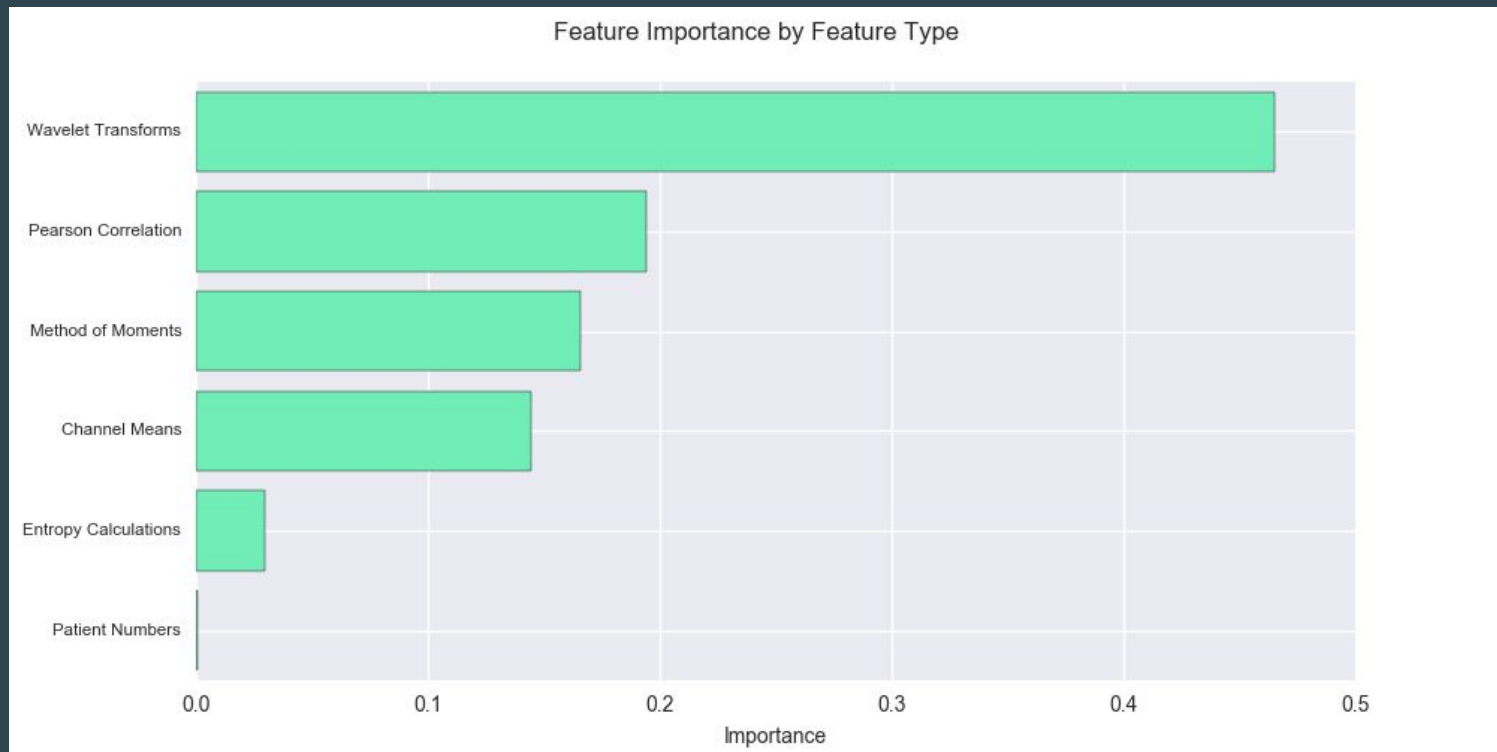
One Hour Interictal (Baseline) Recording



One Hour Preictal (pre-seizure) Recording



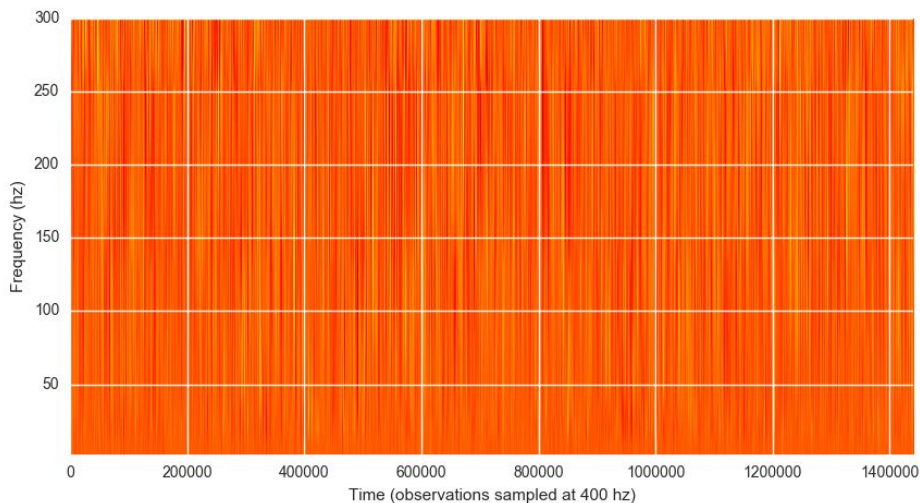
Feature Building - 819 total features



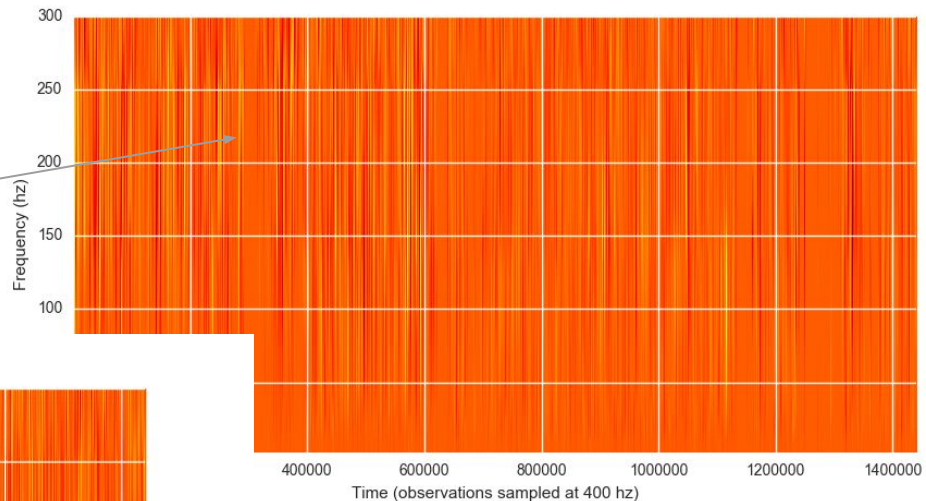
Wavelet Transforms

High frequency activity

Preictal Wavelet Spectrogram from Channel 1

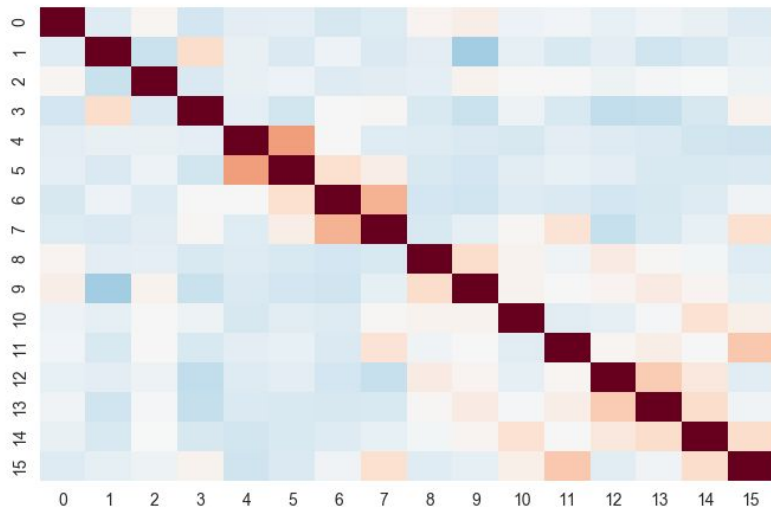


Interictal Wavelet Spectrogram from Channel 1

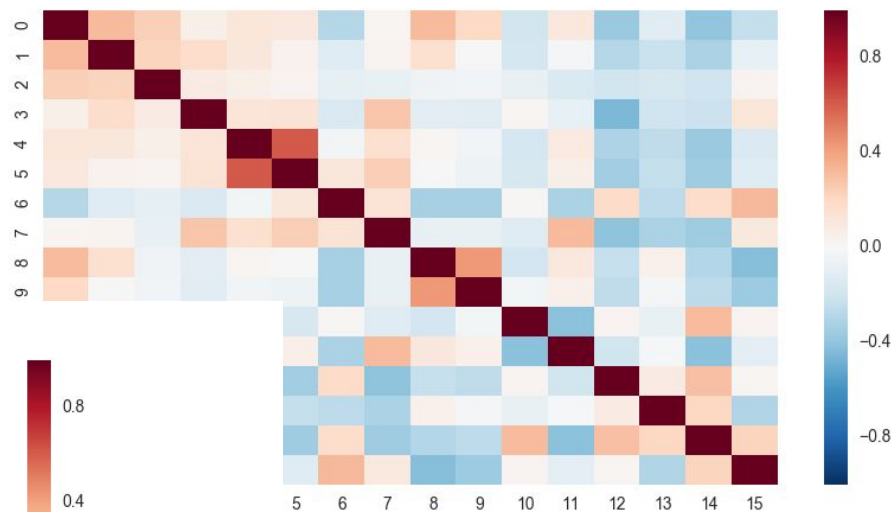


Pearson Correlations

Preictal Channel Correlations

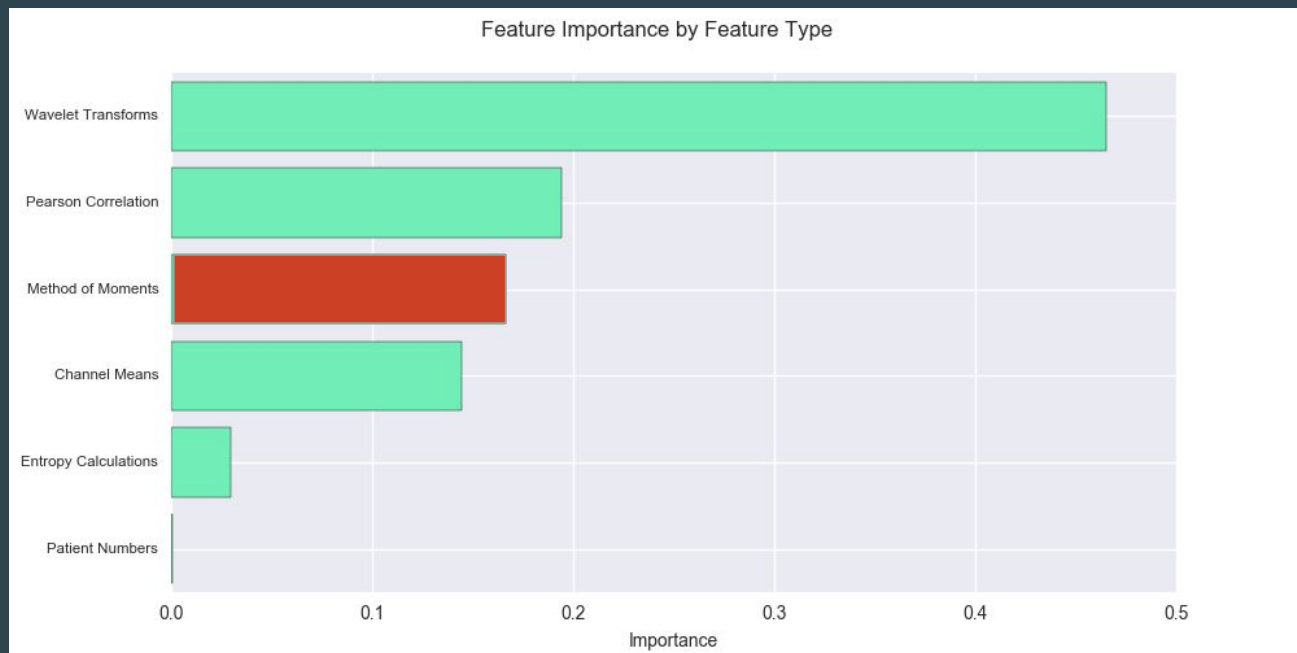


Interictal Channel Correlations

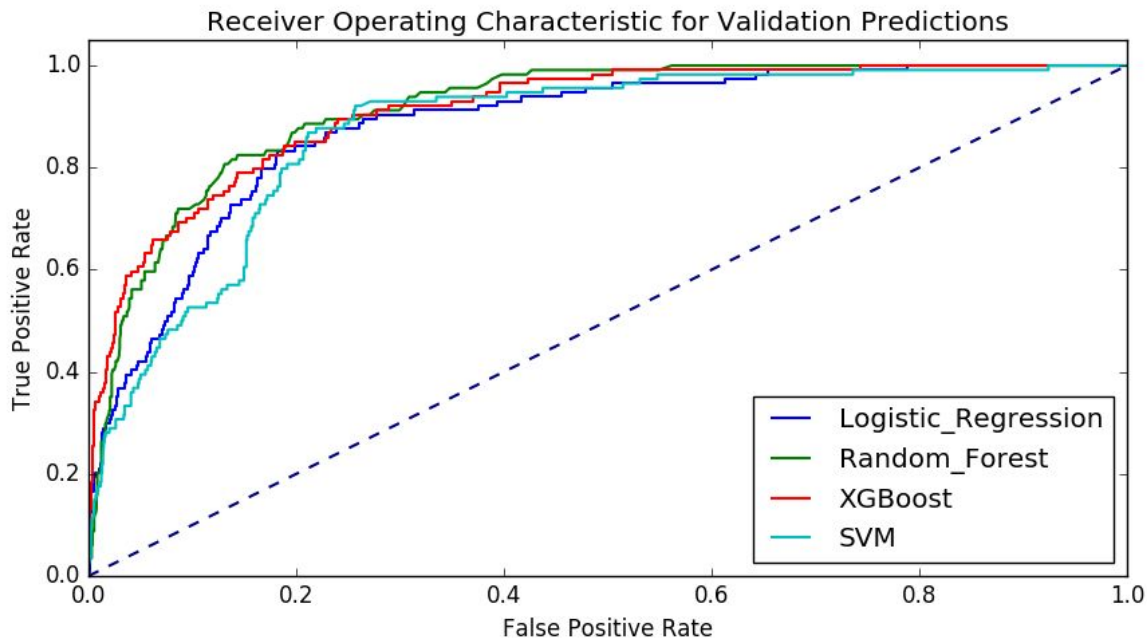


Method of Moments, etc.

- Mean
- Variance
- Skew
- Kurtosis
- Entropy
- Min/Max
- Median



Final Scores



Patient	Logistic Regression	Random Forest	XGBoost	SVM
Combined	0.81 / 0.88	0.88 / 0.91	0.91	0.84 / 0.87

Next Steps

- Understanding feature interaction
- Bayesian live model
- Side data
 - Metric of severity of patient's epilepsy
 - Calibration of the system to attain better baseline
 - Activity data to address what's influencing a given brain state
- Additional wavelets: Morlet and 'spike-and-wave'
- Convolutional Neural Nets

Thank you!

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github.com/conorbmurphy/Predicting-Seizures

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