Melbourne University AES/MathWorks/NIH Seizure Prediction

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November 28, 2016

Overfit

Problem Description

Introduction

- Nearly one-third of patients with epilepsy continue to have **seizures** despite optimal medication management [1].
- Seizures are a symptom associated with abnormal electrical activity in the brain.
- What is a seizure? and When to detect it? questions remain elusive.
- Plenty data is available, **machine learning** can help in building seizure forecasting systems.
- **Could save life!**

Problem Description

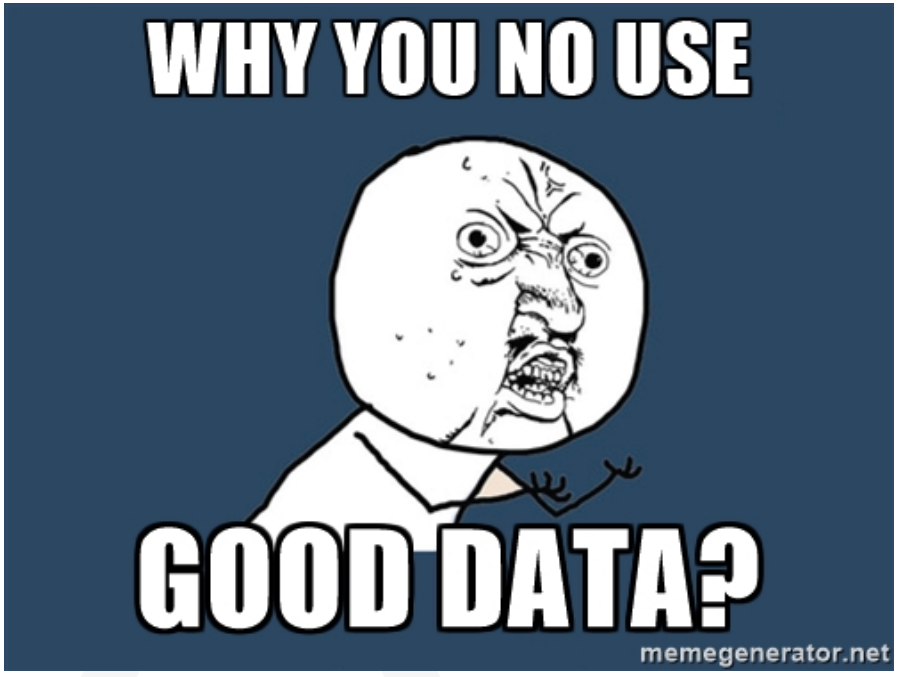
Melbourne University AES/MathWorks/NIH Seizure Prediction

What is given and what is required?

- Human brain activity (intracranial EEG) taken from multiple sensors on brain.
- Each recording is **10 minutes** long, recorded at **400 Hz** resulting **240,000** data points per recording.
- Challenge is to classify unseen recording as **Preictal** (prior to seizure) or **Interictal** (at least an hour before seizure).

Problems with Data Set

There are only two types of people in the world, those who can extrapolate from incomplete data...

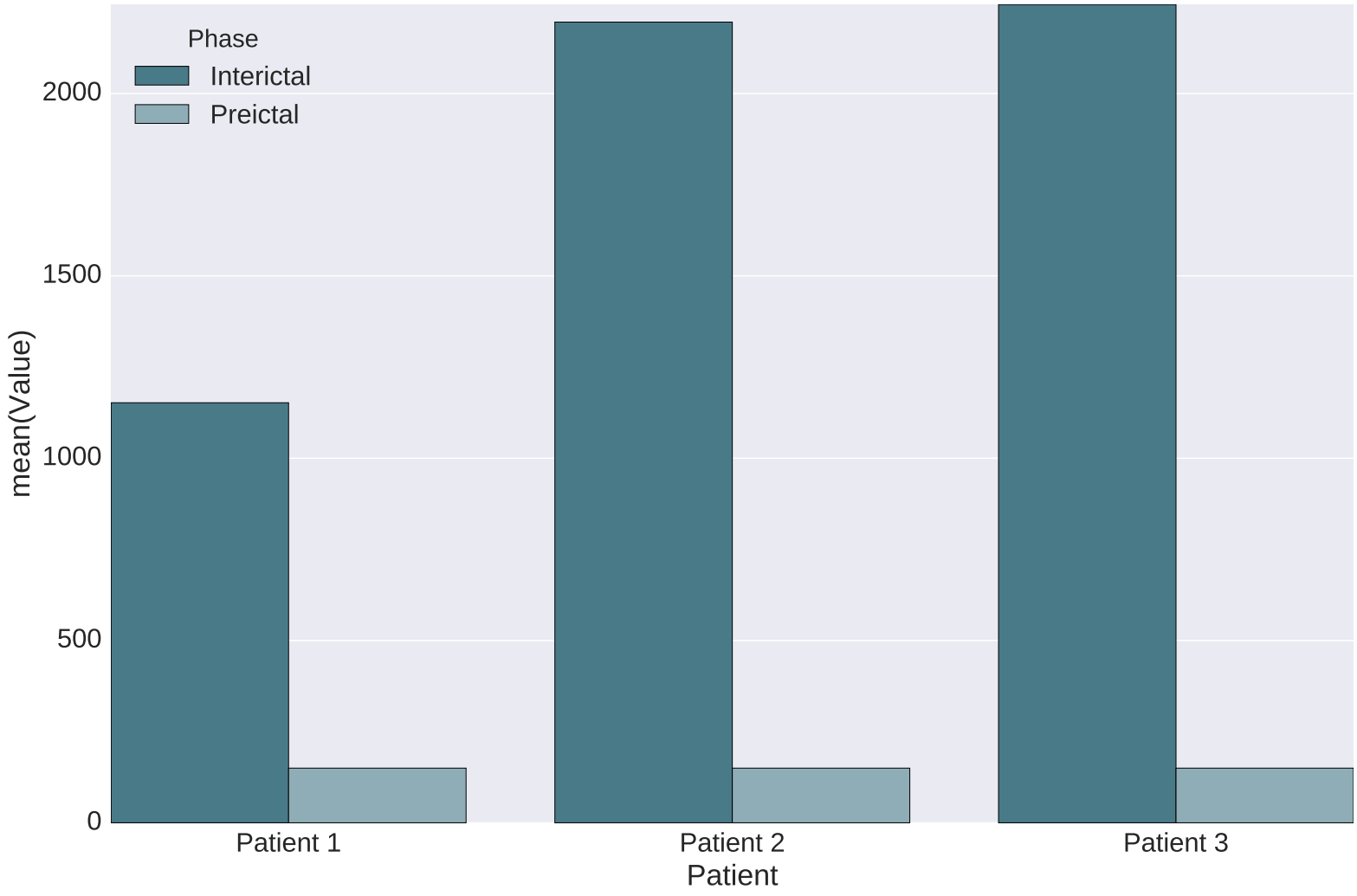


Training Data-set has...

1. Categorical Imbalance
2. Missing Data or Random Dropouts

Problems with Data Set

Categorical Imbalance



Problems with Data Set

Missing/Dropouts in Data Set

- Random dropouts of **10 seconds or more** in the EEG signals across all the 16 channels.
- Exist in **abundance** (even in testing data set).
- Some training data is **entirely empty** (completely missing!!!)

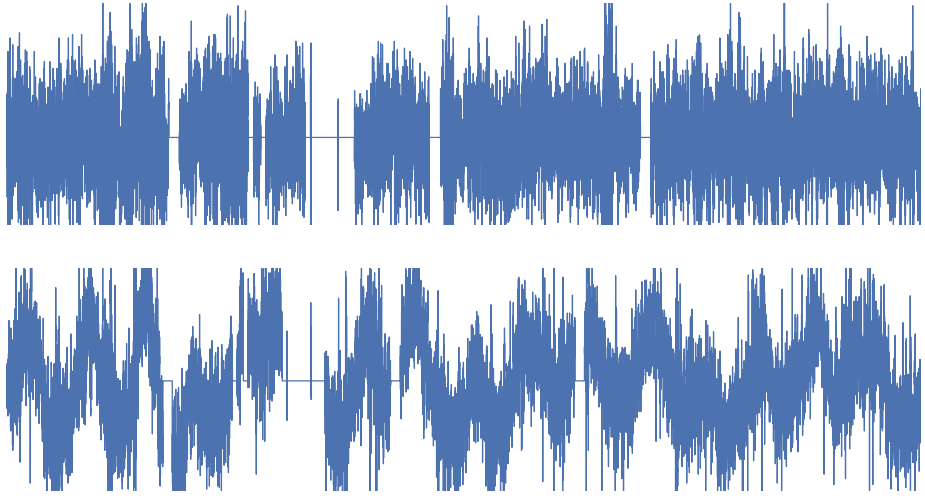


Figure: Missing data in channel 1 and 3 from Patient 1's data set

Classification

Ingredients of our present classifier...

Ensemble of 3 different classifier models:

1. **Deep Learning:** CNN classification of Spectrograms
2. SVM classification on **Random Transforms** of Spectrograms
3. SVM/LR/RF classification using various **DSP features**

Kaggle score

We are at AUC $\sim$ **0.74** as of now.

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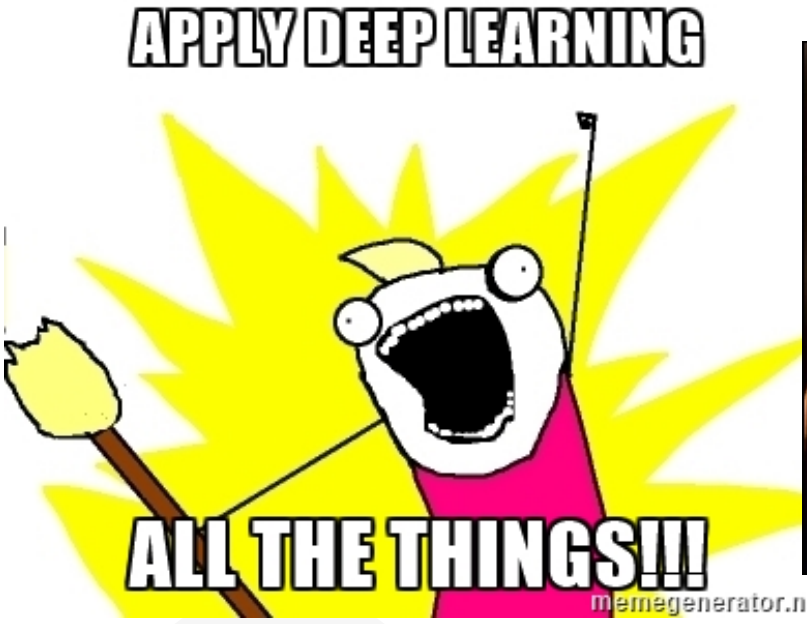
Model 1: Deep Learning (CNN) on Spectrograms



Model 1: Deep Learning (CNN) on Spectrograms

Some background research ...

Why Convolution Neural Networks?

- Our **eternal love** for deep learning...
- CNN has been successful in [2].
- Iryna Korshunova's CNN [2] approach among top 10% in last year's competition.
- RUIFAN give me more references!!!

Options

Fine adjustement of the watermark position

- `hoffset`
- `voffset`

They admit any *positive* or *negative* spacing unit
Note that some warnings about *badboxes* might be generated at compilation

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S. Ramgopal, S. Thome-Souza, M. Jackson, N. E. Kadish, I. Sánchez Fernández, J. Klehm, W. Bosl, C. Reinsberger, S. Schachter, and T. Loddenkemper, "Seizure detection, seizure prediction, and closed-loop warning systems in epilepsy," vol. 37, pp. 291–307.

I. Korshunova, "Faculty of sciences,"