The impact of filtering data in EEG classification

Antoine CHEHIRE   Drew Kristensen   Adel Nabli

INTRODUCTION

- **Purpose** Electroencephalography (EEG): capture electrical activity of the human brain
- **Can be used** in Brain-Computer Interface field
- **Problem:** Very noisy data, component of interest only one of the several components of the signal:

- *Component of interest:* informative cortically generated signal
- electromyography (EMG) visible
- electrooculography (EOG) visible
- Noise from the electronics

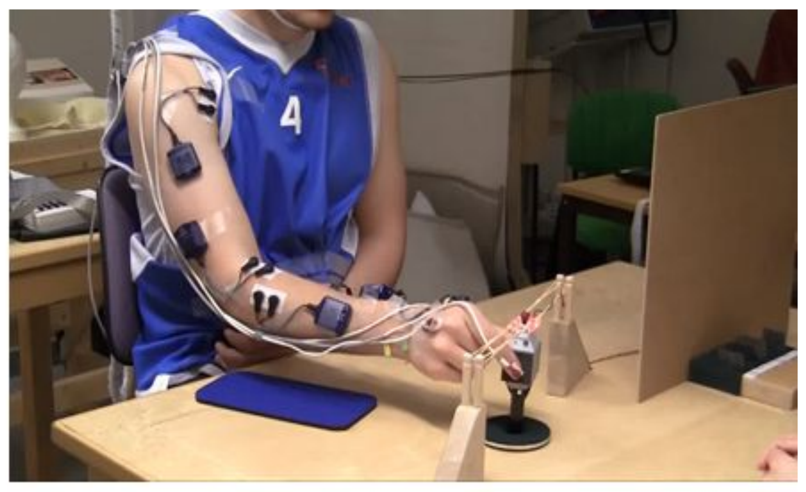
- **Solution**: pre-process the data to eliminate the contamination
- **Our problematic**: *Can filtering methods help the classification task ?*

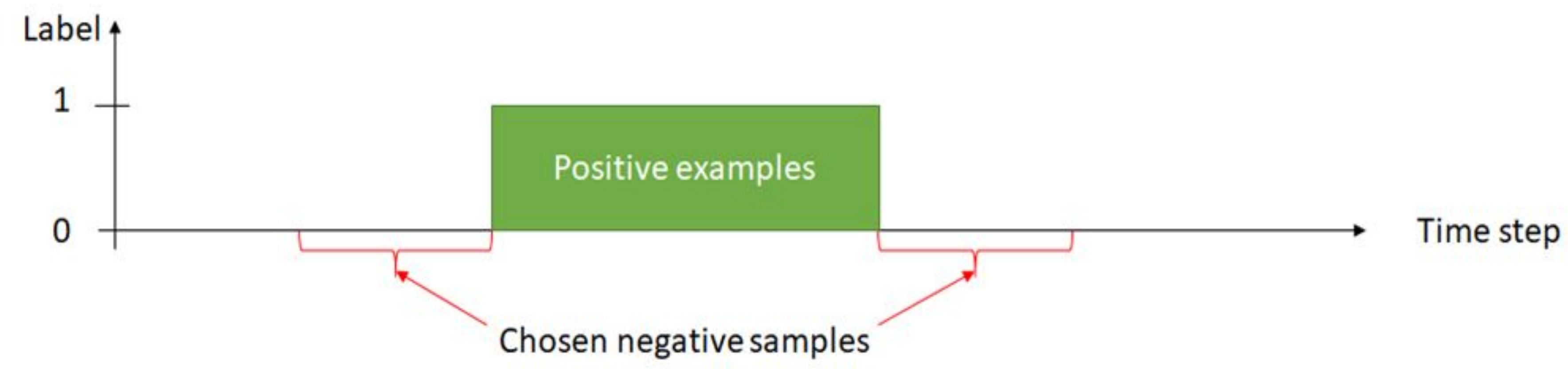
DATA

Kaggle: 6 binary classification datasets

- Hand start
- Touching
- Grasping
- Lift
- Replace
- Release

Over 97% of data is negative example





Captures transitions: Difficult task   53% Accuracy with noisy data

KALMAN FILTERS

Kalman filters are extensions of Markov chains, which better allow us to handle noisy data. Since the real world is often noisy, either due to the sensors used or the underlying processes, using a Kalman filter give us a quick and easy way to track the underlying states we want to know.

We assume that all processes have a Gaussian noise that is inevitable from the nature of real world workings. Furthermore, we assume that our observations also have Gaussian noise, as sensors can never be perfect all the time. Using this, we can better visualize our data. On the right, you see the layout of a Kalman filter, as well as 4 examples of our Kalman filter on EEG data. The orange is the predicted true state, and blue is what we observed.