



BR41N.IO

Unresponsive Wakefulness Syndrom Data Analysis

Team Members:

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INTRODUCTION

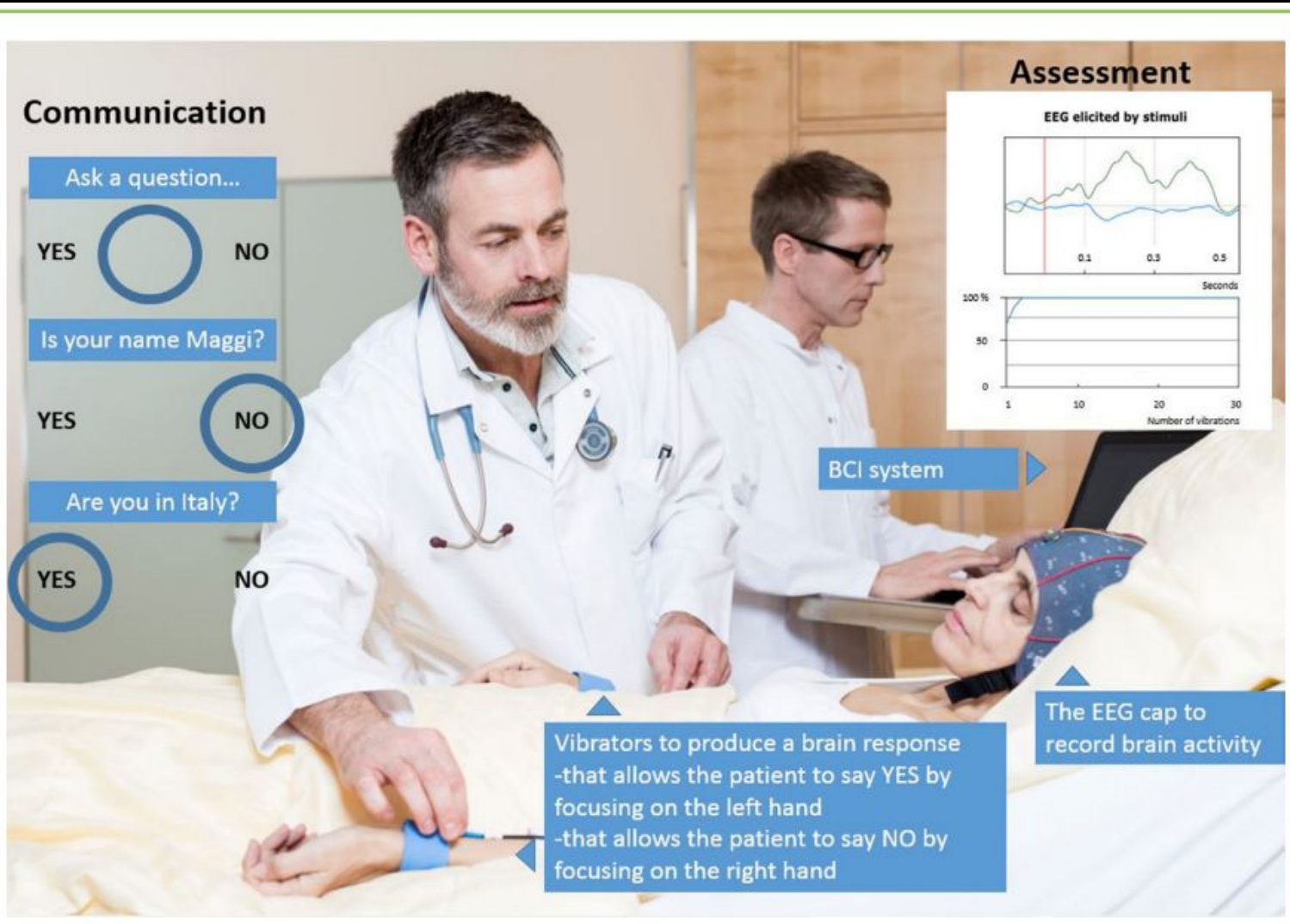
The unresponsive wakefulness syndrome (UWS), formerly known as the vegetative state, is one of the most dramatic outcomes of acquired brain injury. Patients with UWS open their eyes spontaneously but demonstrate only reflexive behavior; there are no signs of consciousness.

Communication in people with unresponsive wakefulness syndrome (UWS) is difficult. Traditional methods, such as bedside observation, are not always reliable. Brain-computer interfaces (BCIs) offer a promising new approach to assessing consciousness and communication in (UWS) patients. BCIs are devices that can translate brain activity into commands, allowing patients to communicate even if they are unable to move or speak.

P300 BCIs measure the electrical activity in the brain that is associated with reaction to stimuli and the signal processed



A method for establishing communication with patients in an unresponsive wakefulness state:



Determine the moment when the patient concentrates on the target hand by analyzing the EEG signals.

Target Hand: focusing by counting
Other Hand: Non target
Foot: Distractor

Subject	File Name	Accuracy
P1	P1_low1.mat	< 5%
	P1_low2.mat	
	P1_high1.mat	> 95%
	P1_high2.mat	
P2	P2_low1.mat	< 5%
	P2_low2.mat	
	P2_high1.mat	> 95%
	P2_high2.mat	

Variable description:

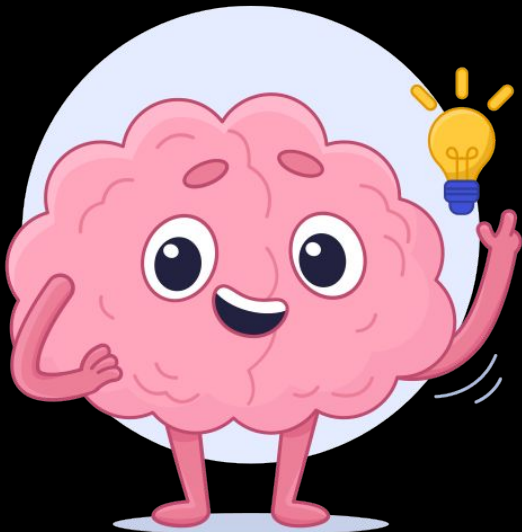
fs ... Sampling rate in Hz

y ... EEG data (samples x channels)

trig ... Trigger data (-1 ... distractor, +1 ... nontarget, +2 ... target)

How to detect P300 signals

1. Threshold by peak detection
2. Template Matching Algorithm
3. **Classifier of the events**



Classifier of the Events

1 Method

Events are classified based on their waveform features.

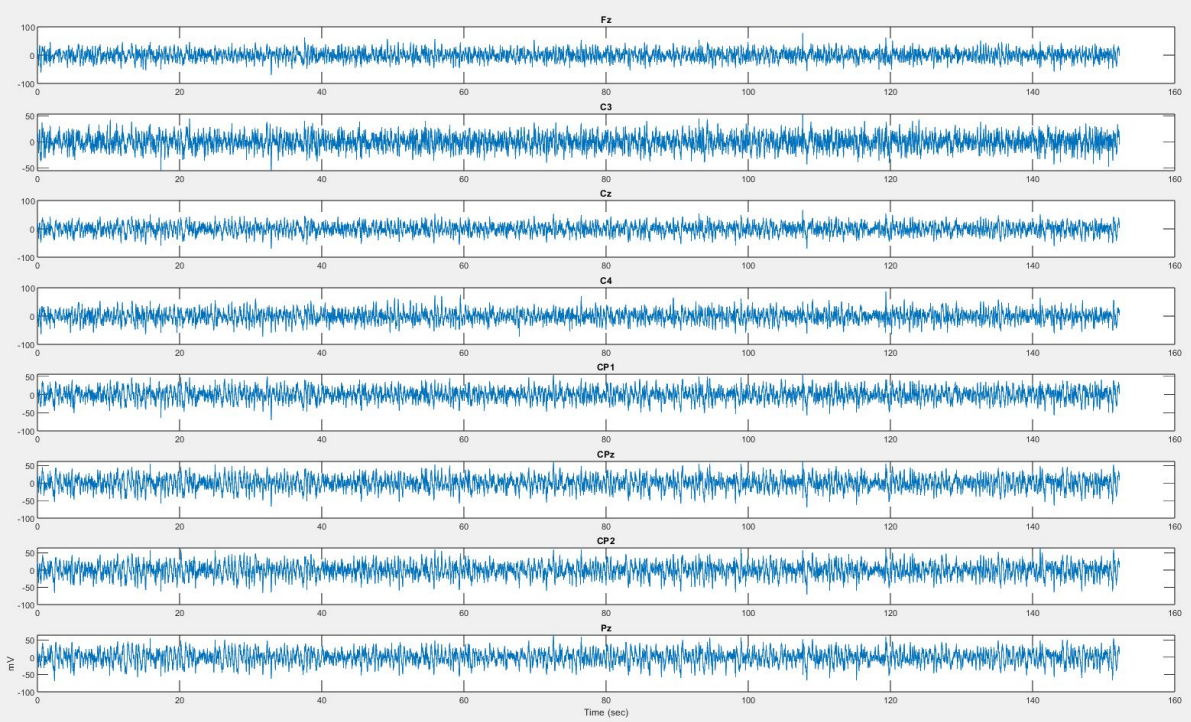
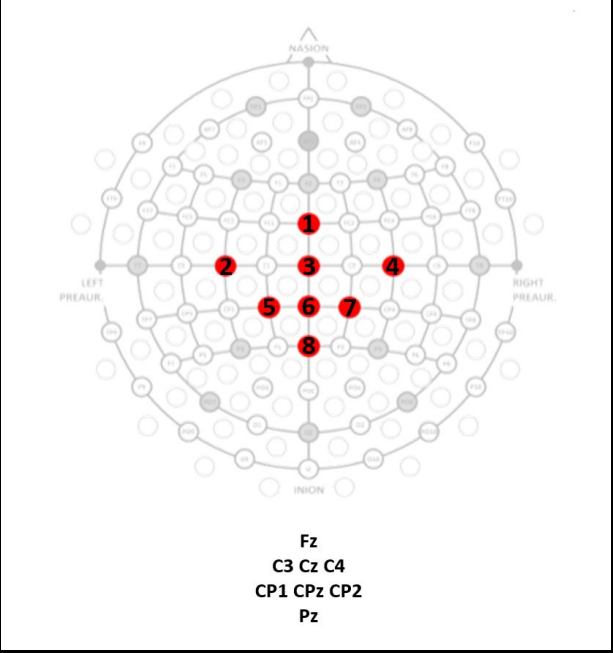
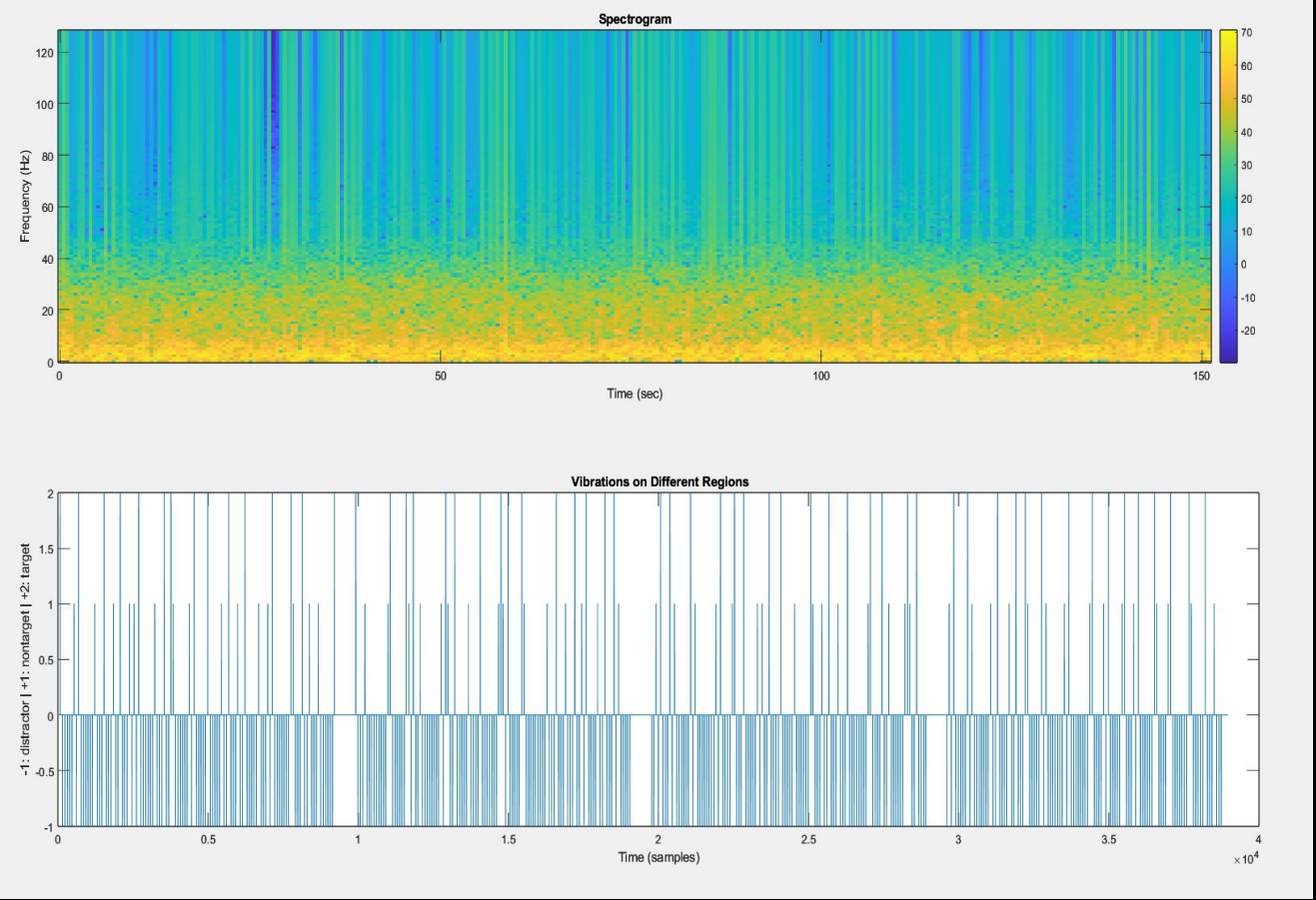
2 Advantages

This method can detect P300 with high accuracy, even with low signal-to-noise ratios.

3 Applications

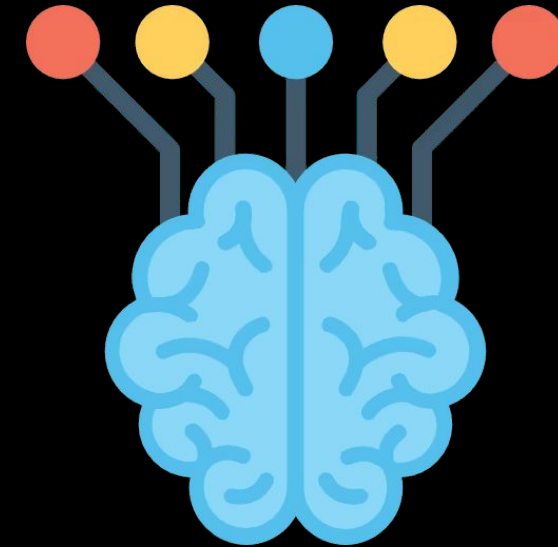
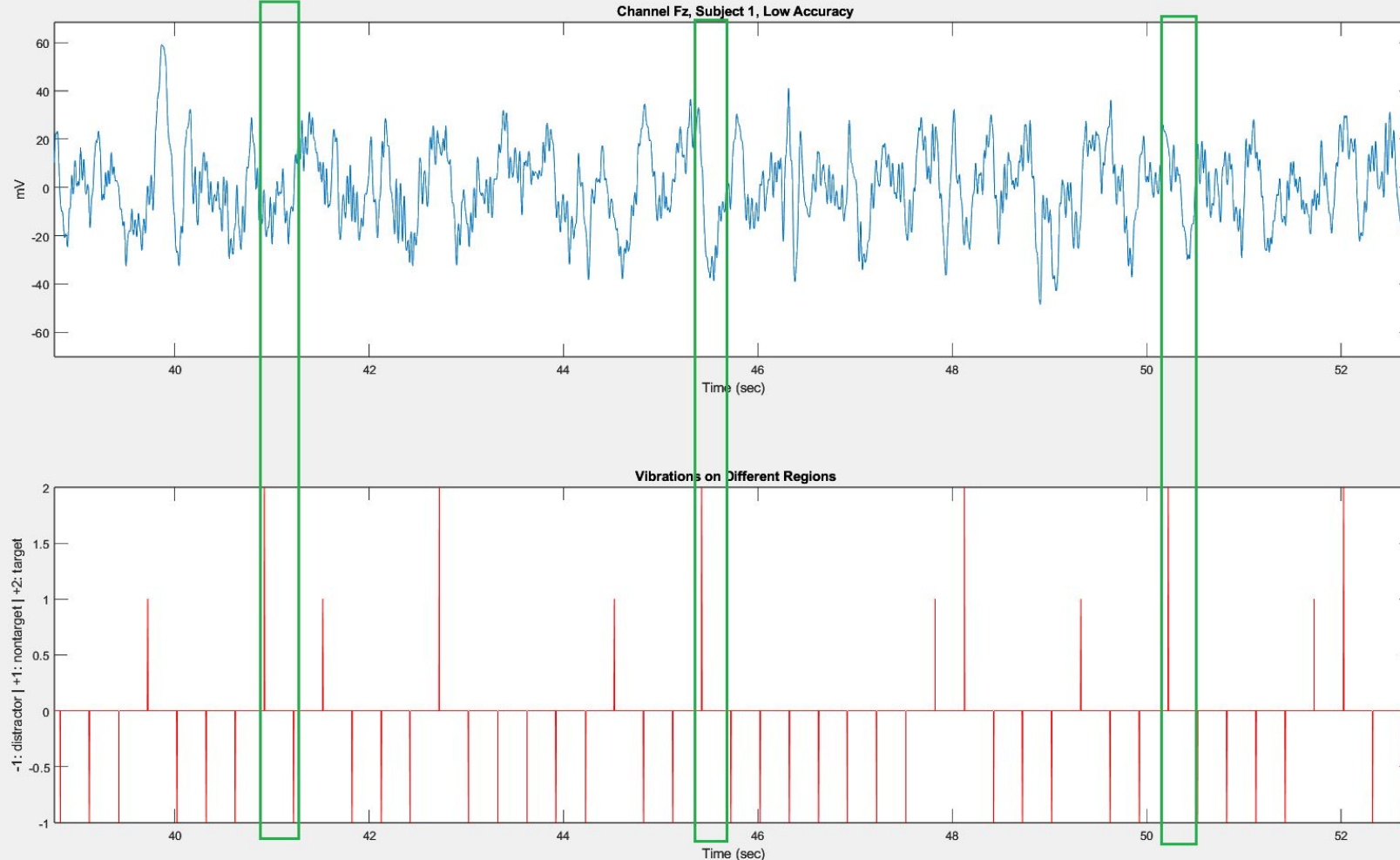
This method is used in various P300-related applications, including speller interfaces and games designed for people with motor disabilities.

Visualisation



Extracting Events' Segments...

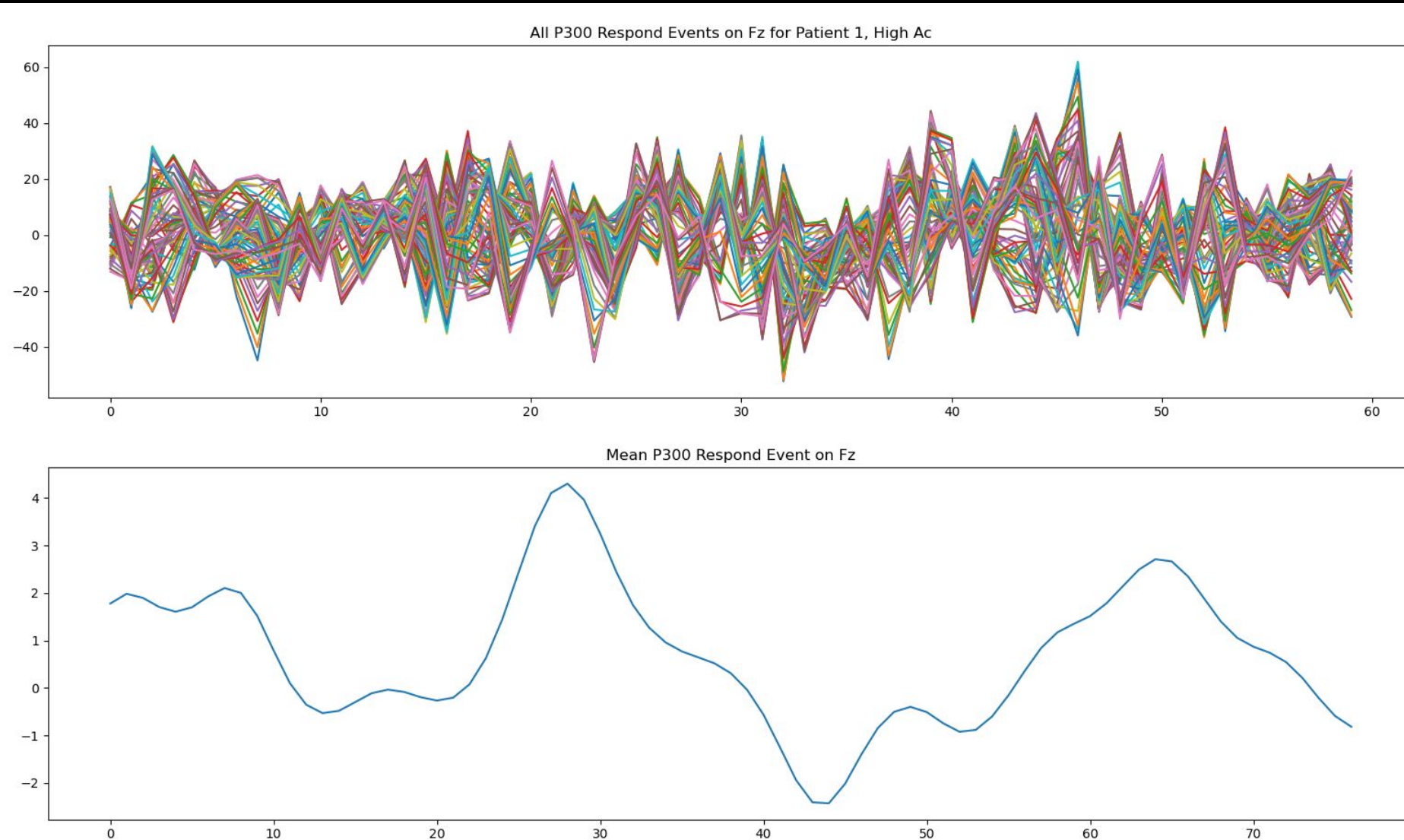
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Mean time between target appearances: 2.53 s
We chose: 500msec after 300msec of respond

Approach...

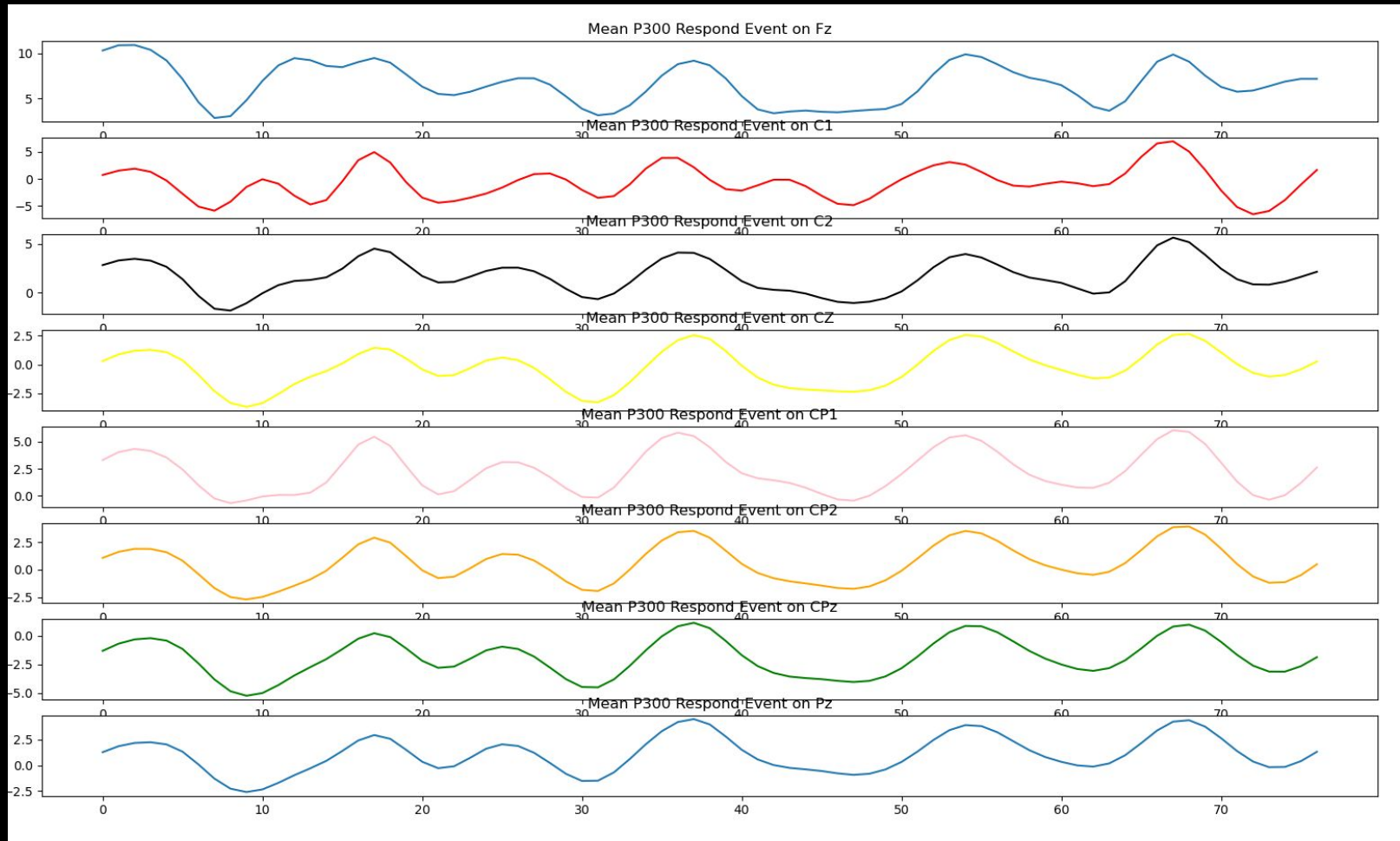
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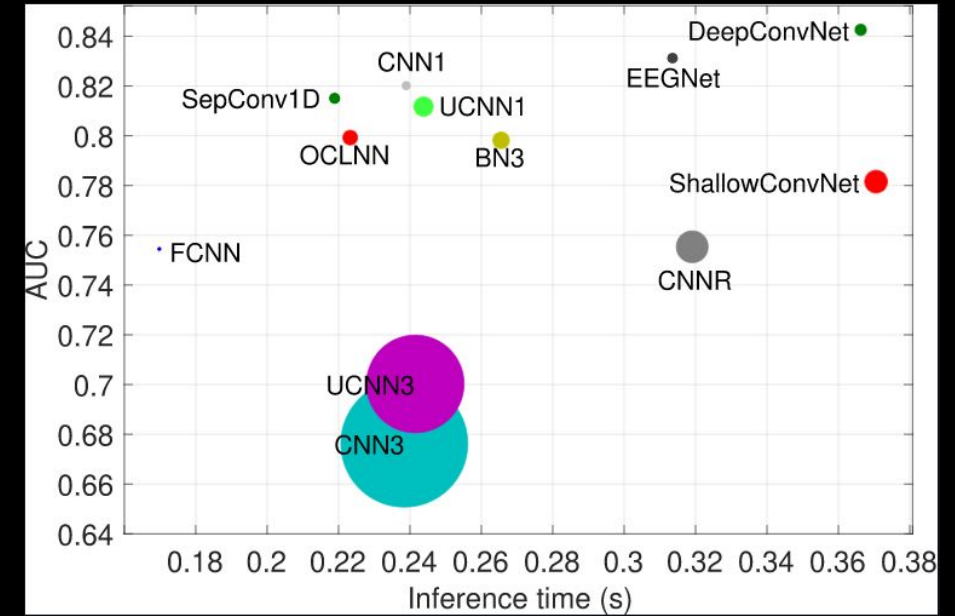
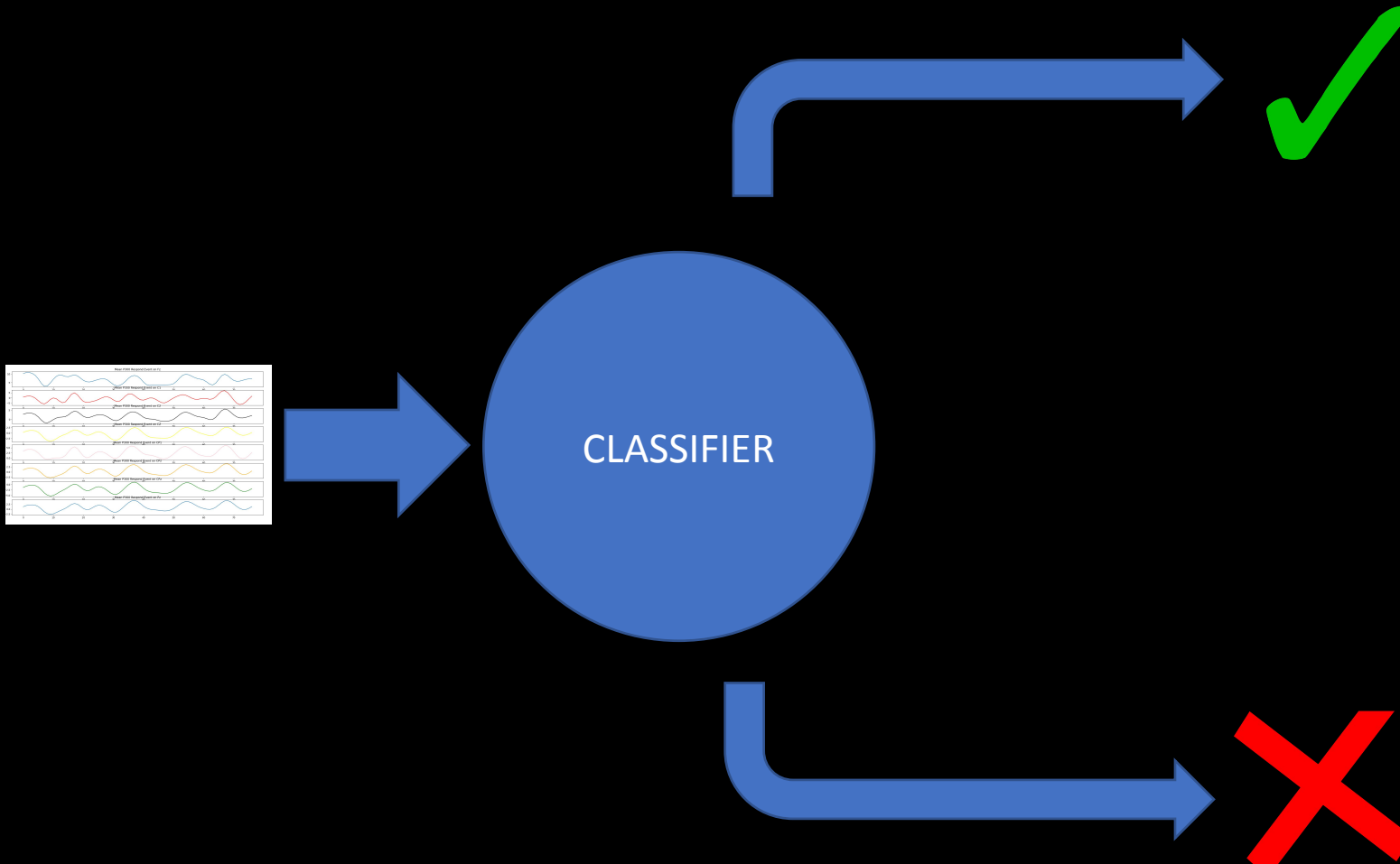
RESULTS

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...get all oscillation for low and for high and train them both separately and with the mean for each channel...
Same both on target hand (+2) AND non target hand (+1)



Get outcome faster!



Reference:

Alvarado-Gonzalez, A. M., Fuentes-Pineda, G., & Cervantes-Ojeda, J. (2021). A few filters are enough: convolutional neural network for P300 detection. *Neurocomputing*, 425, 37-52.



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*"The best and most beautiful things in the world
cannot be seen or even touched - they must be
felt with the heart."
-Helen Keller*

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THANK YOU!