

In The Name of God



*Sharif University of Technology*

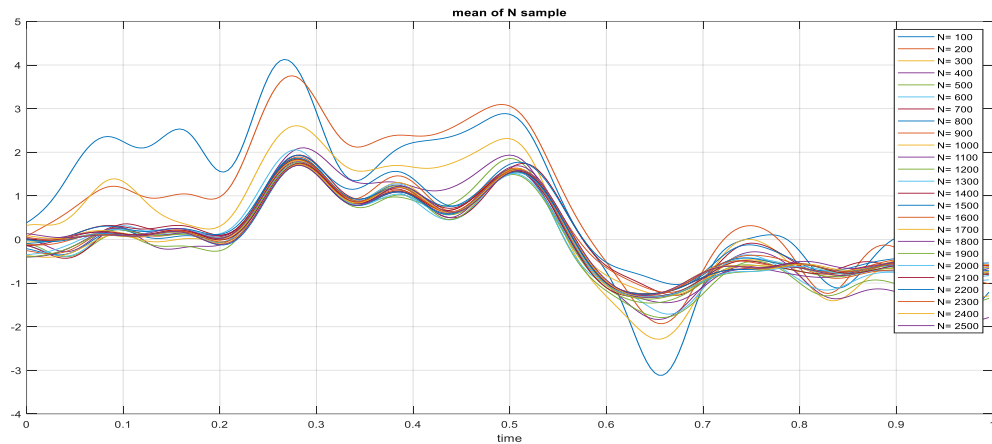
*Dr. Hajipour*

*Amirreza Hatamipour*

*97101507*

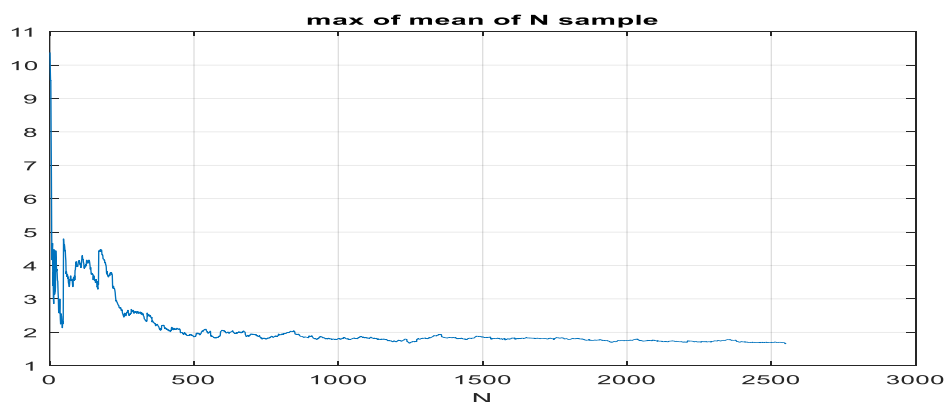
### Question 1:

- a) Afterload the data, we can plot the average of N trials P300. You can see the result for different N from 100 to 2500 on the below plot:



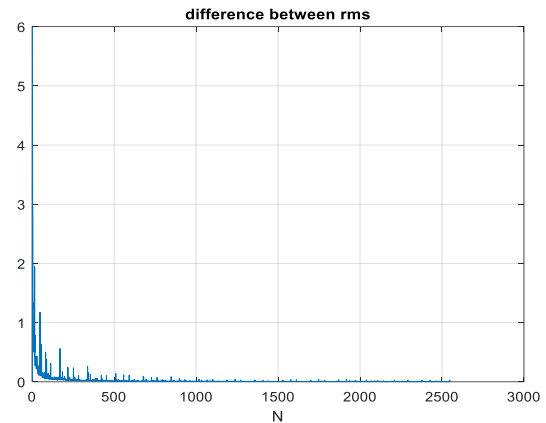
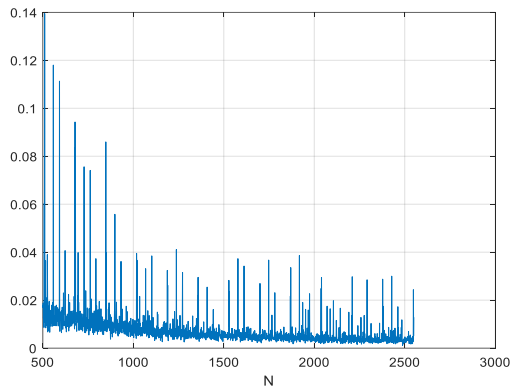
As we see, each N bigger, the average signal is no different from the previous one, and after approximately N=1000, we don't see any difference between the average signal.

- b) We can see the plot in the below figure:



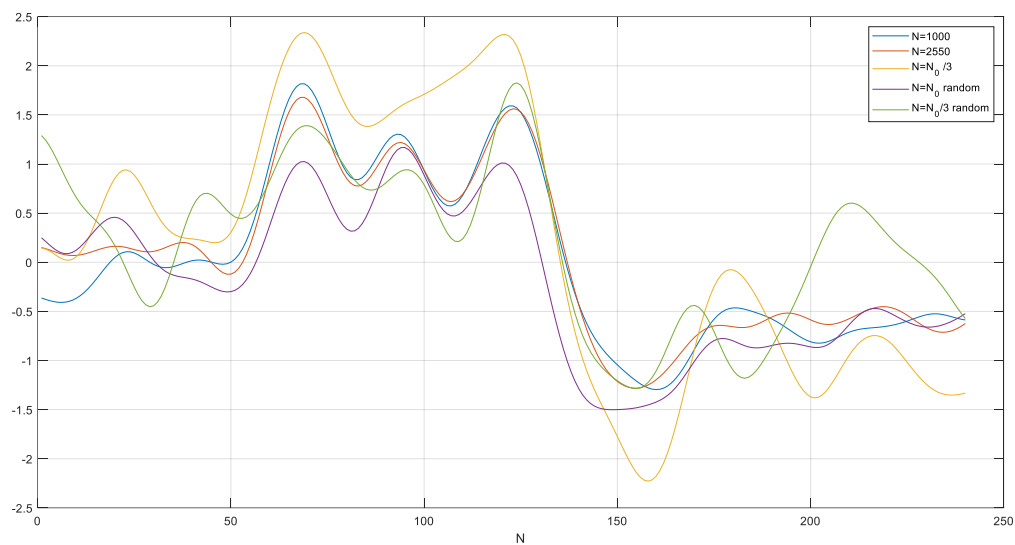
As we see, the higher the value of N, the smaller the difference between the maxima.

- c) And the difference between rms :



d) Based on all the previous sections, I think the  $N_0 = 1000$  is appropriate for detecting p300.

e) In the below figure, we can see the result for the different types of choosing N:

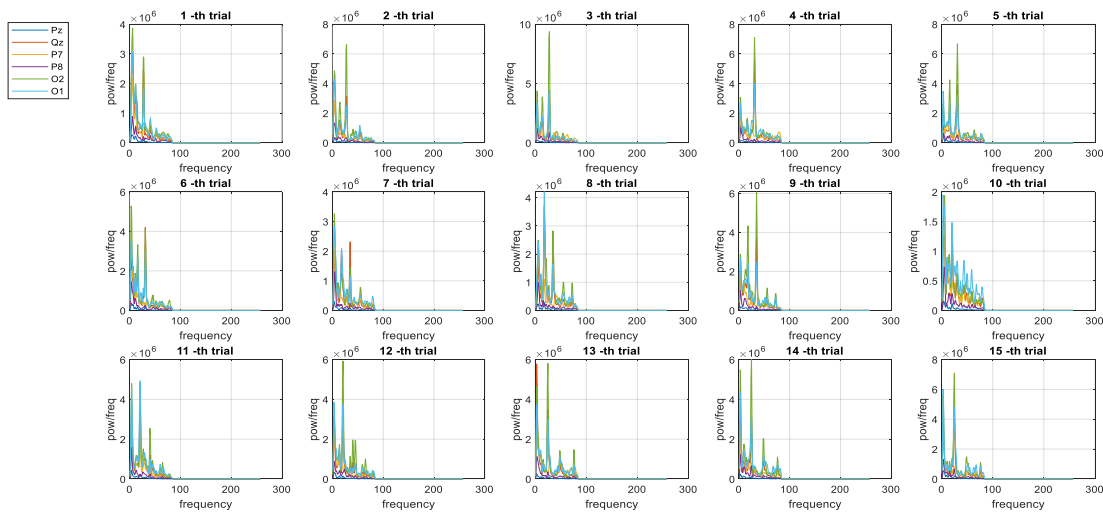


Based on the above figure, we reach to best result when choosing randomly  $N_0$  trials.

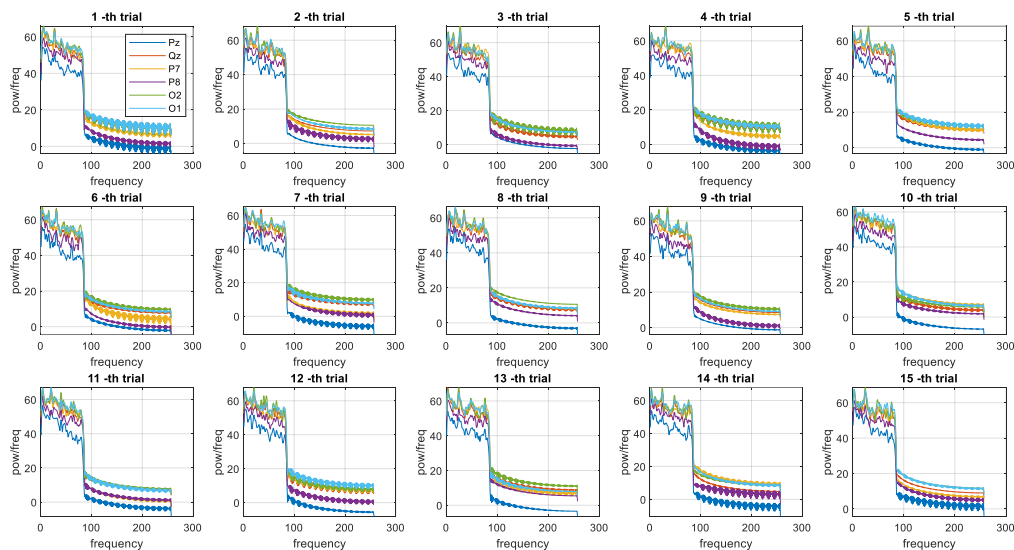
f) in a natural experiment, use very few trials than we reach in the previous section. We can't record 1000 trials from one subject to detect P300 because it needs a long time to record that. So it is boring for the subject.

## Question 2:

- a1) first filter data with a bandpass filter.
- a2) then separate 15 trials from our data.
- a3) on the below figure, we can see the power spectral for 15 trials:



And if we have plotted the spectral power base on DB, we have:



a4) No, in each trial, the Frequency content isn't the same as others. Because in each trial, we have stimulation and the brain's response is different from each other.

a5) for each trial, each channel with a more significant frequency is dominant. The frequency peak in each trial shows the stimulation frequency, and we can see a peak in the harmonics of these frequencies.

B2) after implementing CCA algorithms, we reach the below results:

```
Command Window  
  
acc =  
  
1  
  
fr ~
```

As we see, the result for acc is 1

B3) yes, we can reach the acc=1 with only channels:

```
acc_channel_Pz =  
  
1
```

The result for the different channels is equal to:

```
acc_channel_O2 =  
  
1  
  
acc_channel_P7 =  
  
0.6667
```

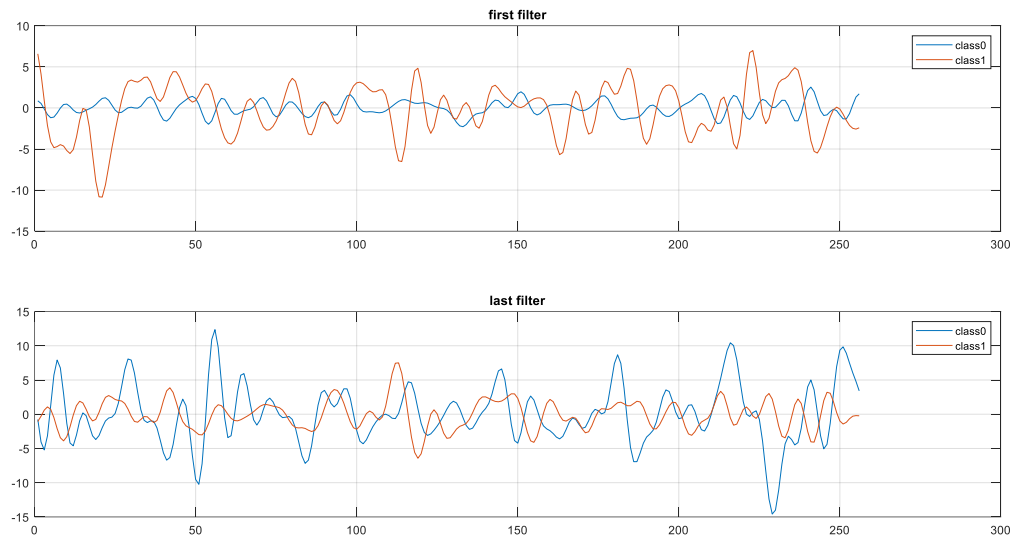
As we see, in some cases, we don't reach acc=1.

B4) the result of different T as shown on the following figure:

```
acc_channel_3T =  
  
1  
  
acc_channel_2T =  
  
0.8667  
  
acc_channel_T =  
  
0.7333
```

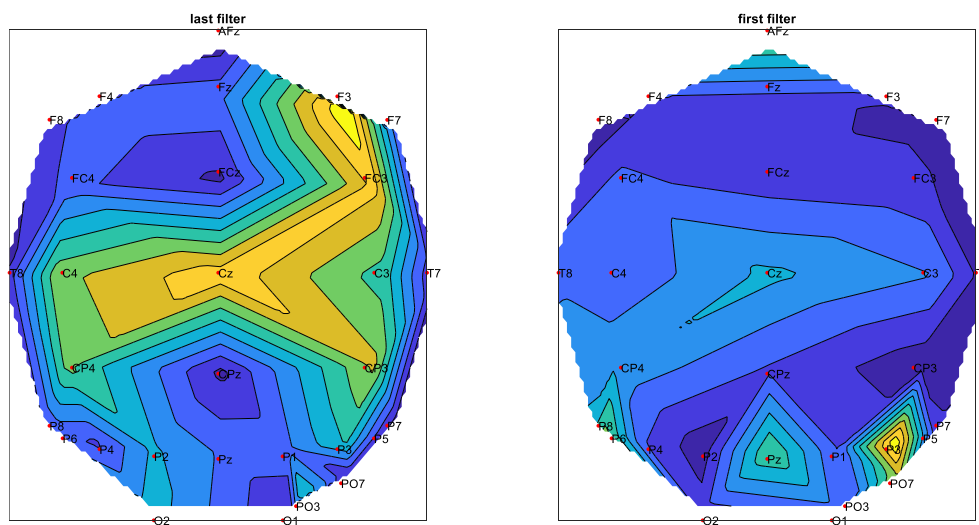
### Question 3:

a) you can see the result of applying two CSP filters on data in the below figure:



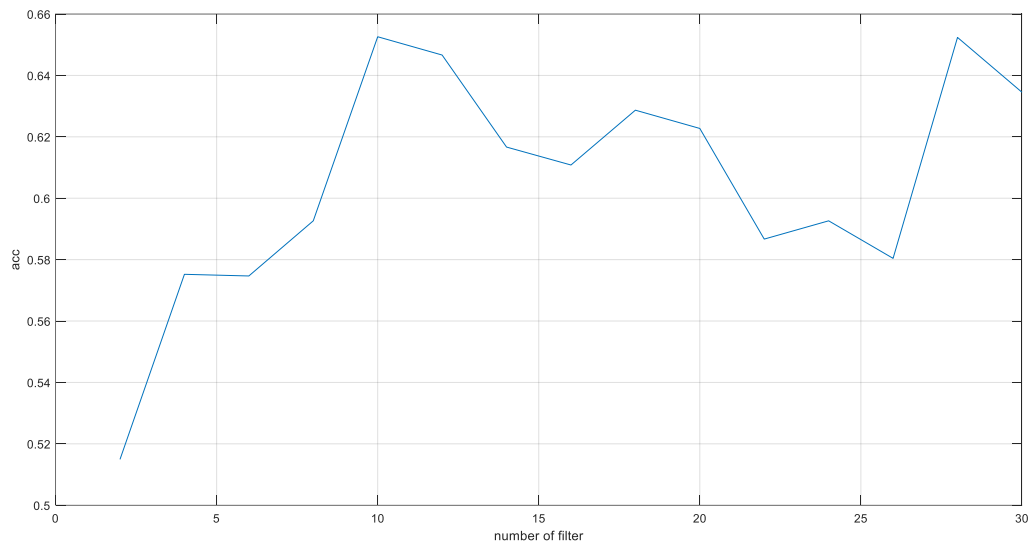
As we see, the two classes aren't separable exactly.

b) if we plot the activities, we reach the below result:



---

c) after calculating CSP for different numbers of filters, we reach the below result:



As we see, the best result of the mean of accuracy on 3\_fold occurs on the number of filter=10.

d) the predicted labels of test data are in test\_label.mat file.