SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering
Computer Engineering Department
Program: B. Tech/MBA Tech EXTC

Course: B. Tech (EXTC)
Faculty: Dr Avinash Tandle

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Program : B.Tech	*Division:*
Batch:	*Date of Experiment:* 20-01-2022
Date of Submission: 25-01-2022	*Grade :*

Aim:

Feature extraction of EEG Signals

Frequency domain feature: Apply the FFT transform and extract the spectral features calibrate and add windows

Colab Link:

https://colab.research.google.com/drive/1cgQQCJknaSsGHwjAHCZnCnLQctdTFaro?usp=sharing

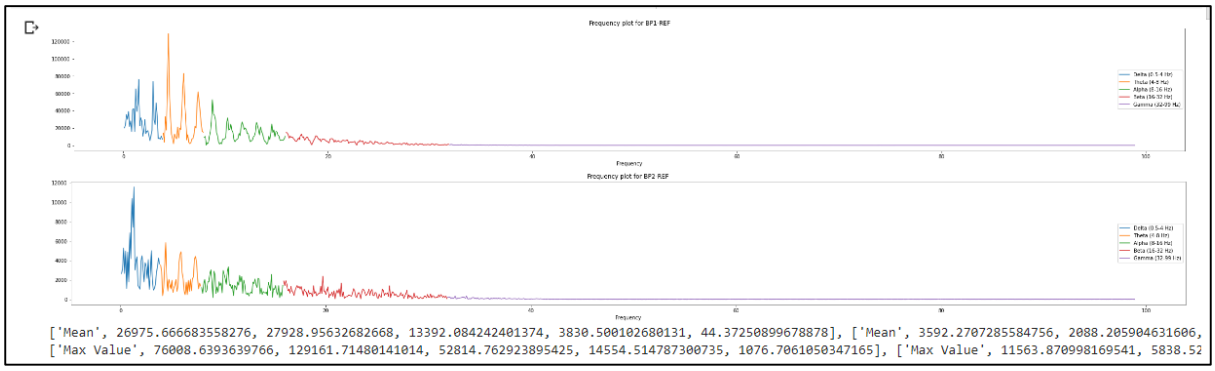
Objective:

1. Calibration

2. Windowing

Data taken from database of Patient 4 -Name of the patient Sanjay Deshmukh

Outputs:



After importing the patient's data, we extracted the ecg and emg data, after that we plotted the channels without calibration and their mean and max values

Without calibration

ECG filtered data Features

	Features	Delta	Theta	Alpha	Beta	Gamma
0	Mean	26975.666684	27928.956327	13392.084242	3830.500103	44.372509
1	Max Value	76008.639364	129161.714801	52814.762924	14554.514787	1076.706105

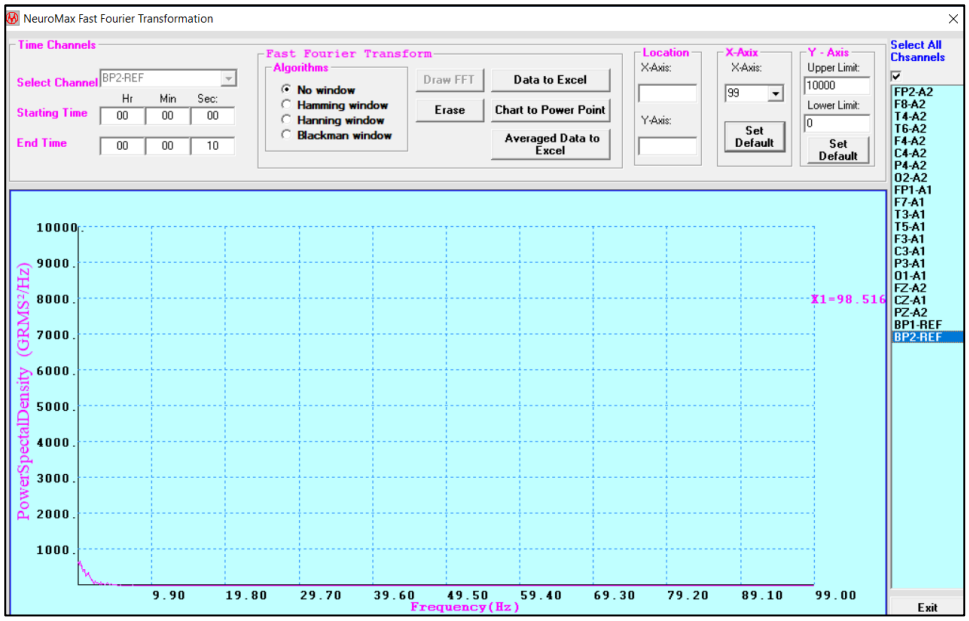
EMG filtered data Features

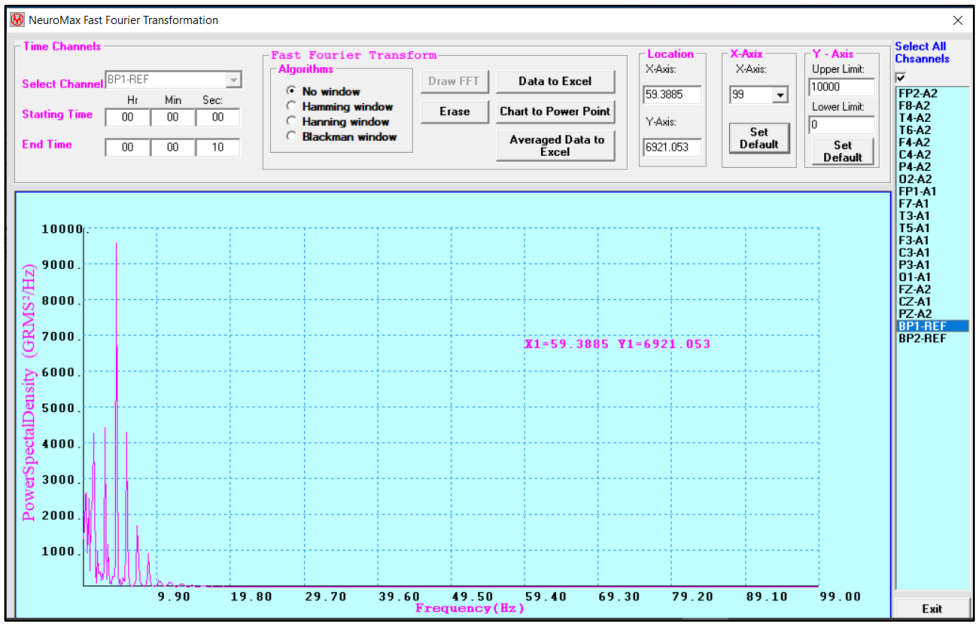
	Features	Delta	Theta	Alpha	Beta	Gamma
0	Mean	3592.270729	2088.205905	1356.583140	579.068330	25.371412
1	Max Value	11563.870998	5838.523313	3337.348561	2376.896675	342.121153

```
[39] #on Neuromax we got a value of 9599.99 in the theta range calliberation value for bp1-ref
     9600.05/129161.71

     0.07432581993533531

[41] #on Neuromax we got a value of 9599.99 in the theta range calliberation value for bp2-ref
     691.0872906273981/11563.870998

     0.0597626254
```

With Calibration

Bp1-Ref = 0.07432584139 BP2-Ref = 0.0597626254





With calibration

ECG filtered data Features

	Features	Delta	Theta	Alpha	Beta	Gamma
0	Mean	2004.989123	2075.843178	995.377929	284.705143	3.298024
1	Max Value	5649.406074	9600.053128	3925.501692	1081.776558	80.027087

EMG filtered data Features

	Features	Delta	Theta	Alpha	Beta	Gamma
0	Mean	214.683530	124.796667	81.072970	34.606644	1.516262
1	Max Value	691.087291	348.925482	199.448712	142.049586	20.446058

Windowing

Hanning Window applied to unfiltered data

	FP2-A2	FP1-A1	BP1-REF
Delta (0.5-4 Hz)	130.077597	40.316470	324.722380
Theta (4-8 Hz)	19.354668	12.032525	165.734373
Alpha (8-16 Hz)	12.118806	6.258694	74.655407
Beta (16-32 Hz)	6.451610	3.093057	31.252223
Gamma (32-99 Hz)	1.293769	1.043240	1.510101

Hanning Window applied to filtered data

	FP2-A2	FP1-A1	BP1-REF
Delta (0.5-4 Hz)	32.300251	22.581739	167.783185
Theta (4-8 Hz)	18.430756	11.342467	159.897063
Alpha (8-16 Hz)	10.741623	5.534015	67.145649
Beta (16-32 Hz)	4.077578	1.882443	21.067684
Gamma (32-99 Hz)	0.207439	0.158499	0.281740

Hamming Window applied to filtered data

	FP2-A2	FP1-A1	BP1-REF
Delta (0.5-4 Hz)	41.001322	24.741580	171.733468
Theta (4-8 Hz)	19.137804	11.594627	163.363108
Alpha (8-16 Hz)	11.274146	5.759974	69.866615
Beta (16-32 Hz)	4.231645	1.953577	22.088469
Gamma (32-99 Hz)	0.215492	0.162580	0.290779

Hamming Window applied to unfiltered data

	FP2-A2	FP1-A1	BP1-REF
Delta (0.5-4 Hz)	136.987506	42.030576	316.638024
Theta (4-8 Hz)	20.096177	12.294480	169.342787
Alpha (8-16 Hz)	12.716486	6.517014	77.704416
Beta (16-32 Hz)	6.710361	3.204128	32.773132
Gamma (32-99 Hz)	1.354201	1.072528	1.557349

blackman Window applied to unfiltered data

	FP2-A2	FP1-A1	BP1-REF
Delta (0.5-4 Hz)	131.182248	33.715205	330.590036
Theta (4-8 Hz)	16.800910	11.043074	152.979105
Alpha (8-16 Hz)	10.532545	5.513861	66.550978
Beta (16-32 Hz)	5.777088	2.778421	27.583012
Gamma (32-99 Hz)	1.154583	0.947574	1.358571

blackman Window applied to filtered data

	FP2-A2	FP1-A1	BP1-REF
Delta (0.5-4 Hz)	23.510923	17.693122	152.196784
Theta (4-8 Hz)	15.989812	10.414877	147.620211
Alpha (8-16 Hz)	9.329407	4.871045	59.914317
Beta (16-32 Hz)	3.668294	1.682890	18.598566
Gamma (32-99 Hz)	0.184152	0.144824	0.251054

Conclusion:

In this experiment we applied feature extraction on EEG Signals and then applied frequency domain feature by apply the FFT transform, extracted the spectral features calibrated and add windows