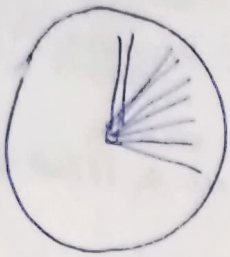
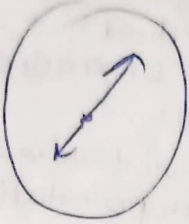




It might cancel out

Trail count makes alot of difference.

31/10/25

Time series → N points

FFT → complete duration.

Wavelet →

→ STFFT: FFT of Short time window

Issue:- Edge Artifacts.

Diff Taper window

difference in energy in center from the Edges.
- Gaussian
- Hamming
- Hann

Time Windows
↓
depends on the lowest freq we want

Eg: 4 Hz → need atleast 2-3 cycles ⇒ 750 ms?

Wavelet vs Filter-Hilbert (FIR)
difference

ITPC
↓
Inter Trail Phase consistency
↓
Next class

Read Chapter Before next class

Time Freq
- FT, STFT
- FFT
- DFT
- Real (complex Morlet
- Hilbert Transform.

Extension of STFFT ← Multitapers } Why is it different

↓ use multiple orthogonal taper
↳ also known as Slepian Sequences

Slightly different temporal & spectral resolution

Phase locked vs Non phase locked across trails.

"When we need improved spectral conch & reduced variance"

Benefits of Multitapers

i) smoothing high freq activity
ii) Non time locked activity ⇒ average out.

Similar to STFT, we can get our FOI

Multitapers used ideally when
- want to Analyze low SNR data
- Single trail data
- greater freq

" help dpss "
↓
In matlab.

Not to use:
- when we want lower Freq (<30 Hz)
  ↳ So, Don't use it in our project

We essentially focus on α, β ← bands.
12-15 Hz
8-10 Hz

Ch 15, 16
code.

3D
EEG.data (channel, time, trail)

Let srate = 1000Hz

timewin = 500

idx = 500 / (1000/srate)

= 500/1000 × srate

= 0.5 × 1000

= 500 samples

hannwin = 0.5(1-cos(2π(0:500-1)/(500-1)))

d = detrend(EEG.data(20:,16)

fft(x)

Exercise
Add multitaper
↳ Submit by weekend

14/11, 18/11 ⇒ Neuro Final presentation

Report should be crystal clear.

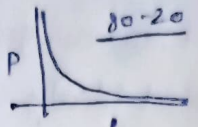
08/11/25

→ TF Analysis : Baseline Normalization

Power law :

$$P \sim f^{-\alpha}$$

$$\log(P) \propto -\alpha \log(f)$$



If low freq dominate in task ⇒ also dominate in Baseline

↓↓

This is why we need Baseline Normalisation

Transform data into same scale enabling ~~comparisons~~ Comparisions b/w freq bands etc..

i) Decible

$$dB_{tf} = 10\log_{10}\left(\frac{\text{activity}_{tf}}{\text{baseline}_f}\right)$$

ii) ~~% change~~ Z-transform

$$Z_{tf} = \frac{\text{activity}_{tf} - \overline{\text{baseline}_f}}{\sqrt{n-1}\sum_{i=1}^{n}\left(\text{baseline}_{tf} - \overline{\text{baseline}_f}\right)^2}$$

apply only when we have sufficient No. of trails

↓↓

And the preprocessing of your data is neat & clear

Avg Across Trails ⇒ To get to know what's happening across trails in general

Baseline Normalisation ↓↓ very Imp (Check for Outliers)

Mean vs Median ?

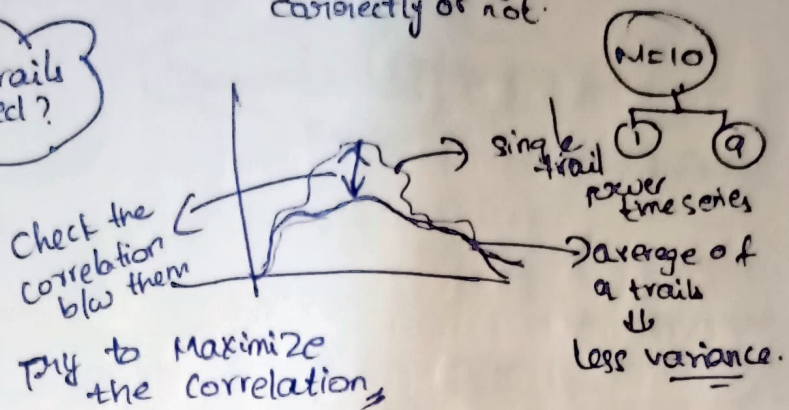
In general → Mean

when we suspect outliers → use it

- single trail z-transforms ⇒ help minimize effects of outliers.
  ↓
  may lead to power fluctuations (that are not real)
  but due to contribution of large SD of Baseline.

Sanity checks for Baseline ⇒ Try diff Baselines
Ensure you're doing correctly or not.

How many trails do we need?



⇒ Try to Maximize the correlation

conditional Diff
t-test?

Simulate power in 2 conditions
- Assuming a small diff blw them in Power (Based on the literature
- Generate EEG data
- Apply statistical method

Succesfully found effect or Not?

Try Doing But Isn't it Hard?
↓
Not Impossible.

Exercise
Ch18 ⇒ DO Ex:2