# Neurophysiological Data Analysis
# Assignment 1.

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**The aim of our first assignment of the *Neurophysiological Data Analysis* course is the visualization and the analysis of an ECoG recording. We had to work with a *.mat* file, containing a $226304 \times 43$ matrix. For the data process, I used *Scilab*.**

# Visualization of the data

As a first step, I visualized the given ECoG data. The recording contains data from 43 channels, its total length is 226, so the sampling rate was 1000 Hz.

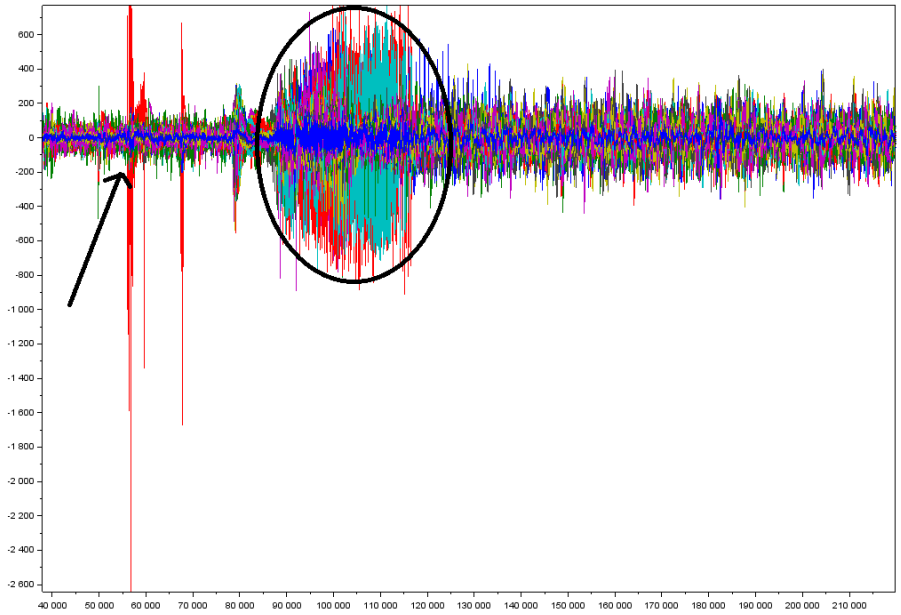


Figure 1: Visualization of the ECoG data in one plane

I indicated the seizure with a circle, as seen on Figure 1. The amplitudes suggest that the activity started at around 90 s.
For further examination, I looked at the recordings of the channels individually. (Figure 2.) This way I could look at the spatial properties of the seizure.

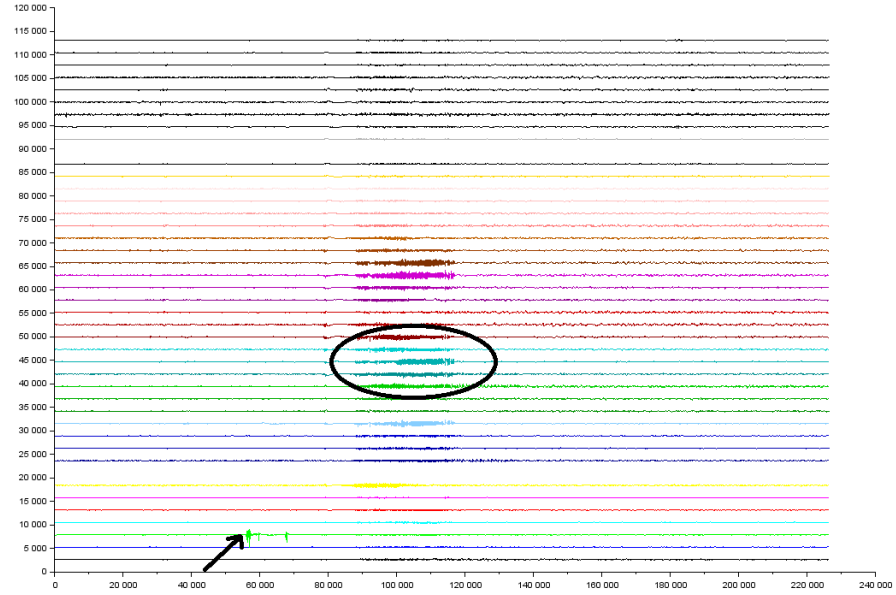


Figure 2: Visualization of the ECoG data looking at the channels individually

Based on Figure 2. the duration of the seizure was about 30 s, from 90 s to 120 s. Its center was somewhere near to the 16th channel (indicated with turquoise blue).

# Comparison

As the second part of the analysis, I looked at the Fourier transform of the signal to determine and compare the frequency properties of the data in the pre-seizure period, between 20 s and 40, and during the seizure between 95 s and 115 s. I chose channel 17 to examine the frequency properties of these time intervals.

Figure 3. shows the frequency properties between 20 s and 40 s, so before the seizure. If we look at the diagram, we can see that the frequencies dominate between the 5-12 Hz band. This is in the range of alpha and theta waves.

As opposed to that, on the diagram of figure 4. the dominant frequency band is higher, around 8-16 Hz. This can indicate epilepsy.

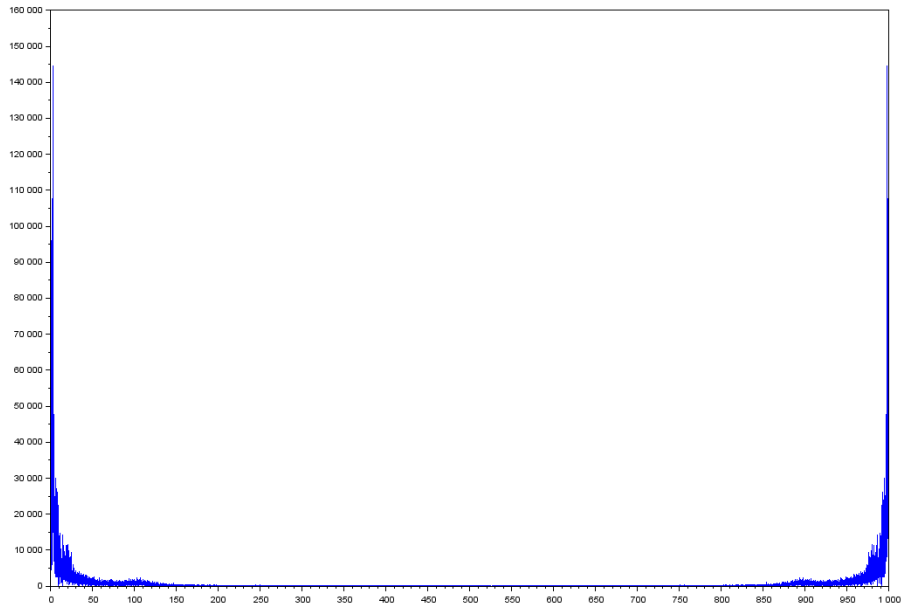


Figure 3: FFT of the data between 20 s - 40 s

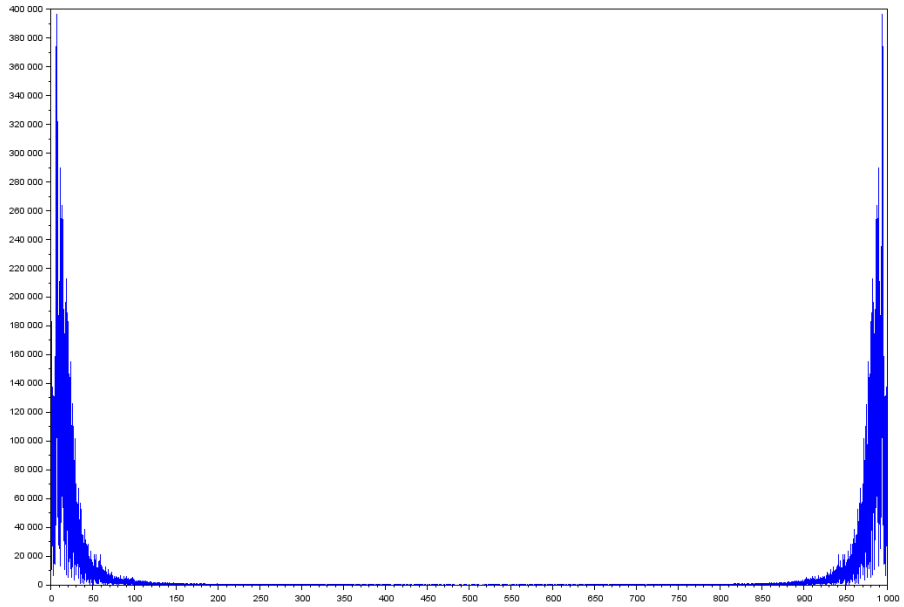


Figure 4: FFT of the data between 95 s - 115 s

## Wavelet transformation

The previously used Fourier transformation is only giving us information about the data in the frequency domain. With the help of the wavelet transformation we can examine the signals in the time and frequency domain simultaneously.

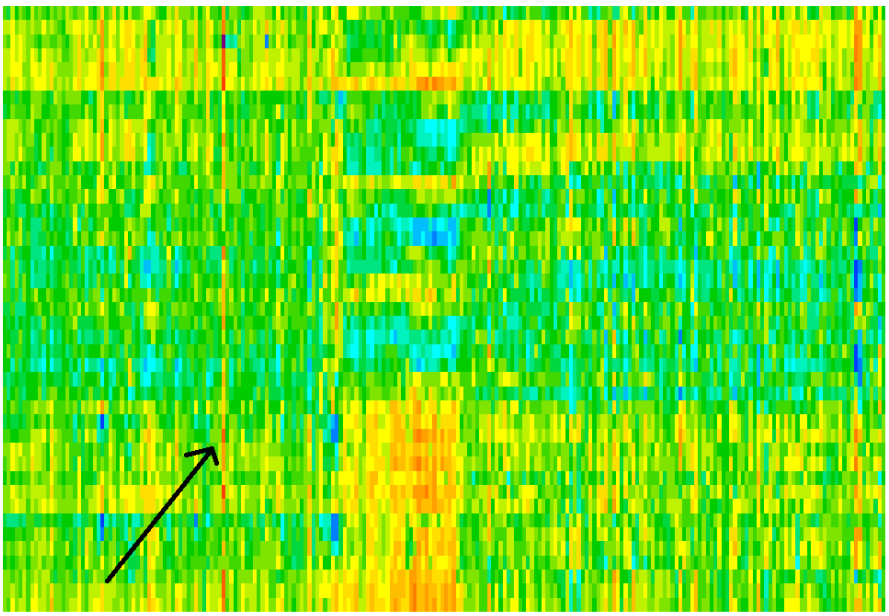

Figure 5: The wavelet transform of the ECoG data. The horizontal axis indicates the time, while the vertical axis represents the frequency.

Figure 5. shows the result of the analysis by wavelet transformation. The different colours represent the magnitude of the amplitude. We can see from the diagram, that before the seizure there was a quiet period, then, as the seizure occurred, the higher amplitudes appeared. After the seizure period, the amplitudes lowered again.

## Location of the seizure onset zone

I indicated the seizure onset zone on figures 1., 2. and 5. with a black arrow. Based on figure 2., it appears on channel 3.