Transformations Continued

Announcements

Lab 2 clarifications available in the starter repository - https://github.com/allegheny-college-cmpsc-105-spring-2024/dot-to-dot-data-orgnization-transformation-starter

Labs are required

Each lab is 6% of total grade

One lab: - 60% determined by gatorgrade score

- 40% split into check -, check, check +

Transformations

Scale	multiplication or division	= cell * scalar
Mean		= AVERAGE(cell:cell)
Center	subtracting out the mean	= cell - $Mean$cell
Normalization to 1	scaling by absolute largest value	
Absolute	value regardless of sign	= ABS(cell)
Largest		=MAX(cell:cell)

Transformations

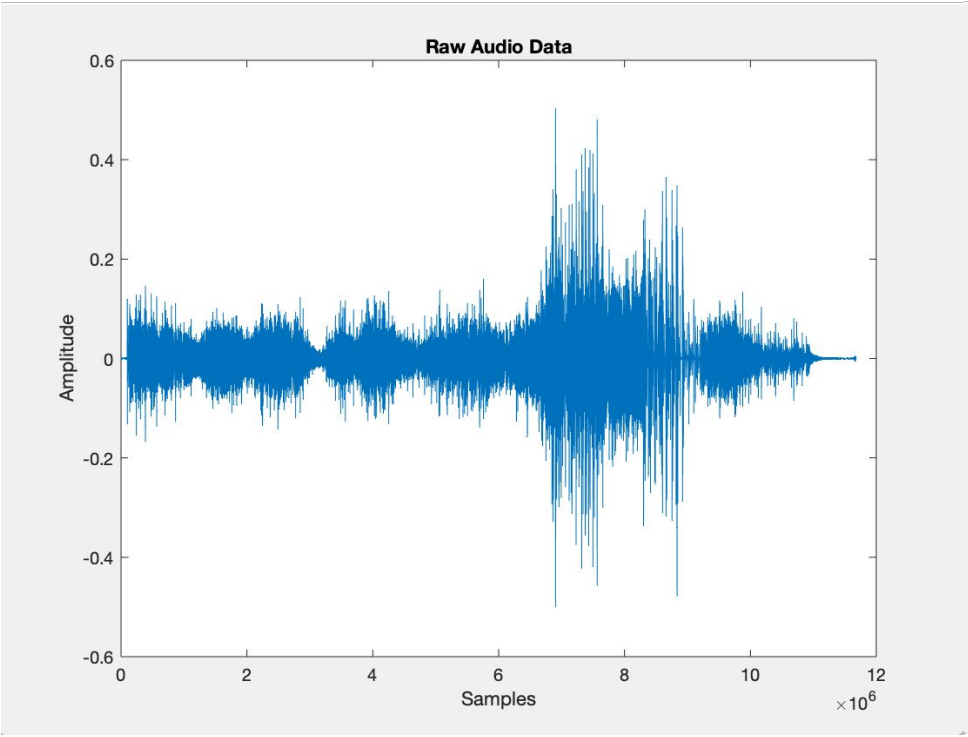
Shift	add or subtract constant	=cell ± constant
Reflect	add or subtract relative	=cell ± 2*($reference - cell)
Decimation	dividing out a (constant) base number until data point is close to 1	=LOG(cell, constant)
Smoothing	compute (limited) moving average	=AVERAGE(cell:cell)

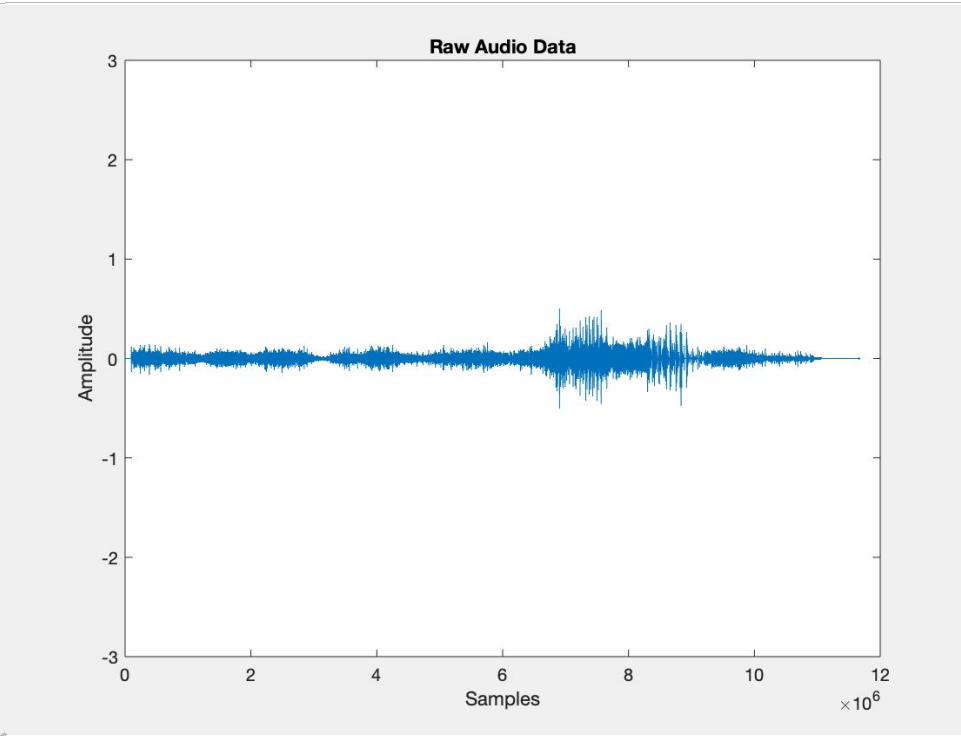
Audio Data example

Audio is sampled

- 48000 Hz

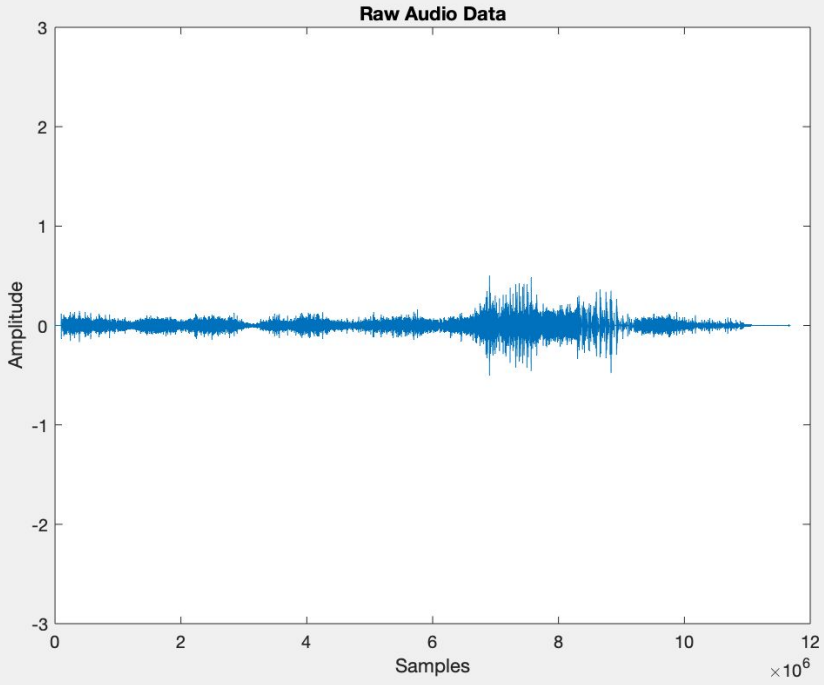
Raw Audio

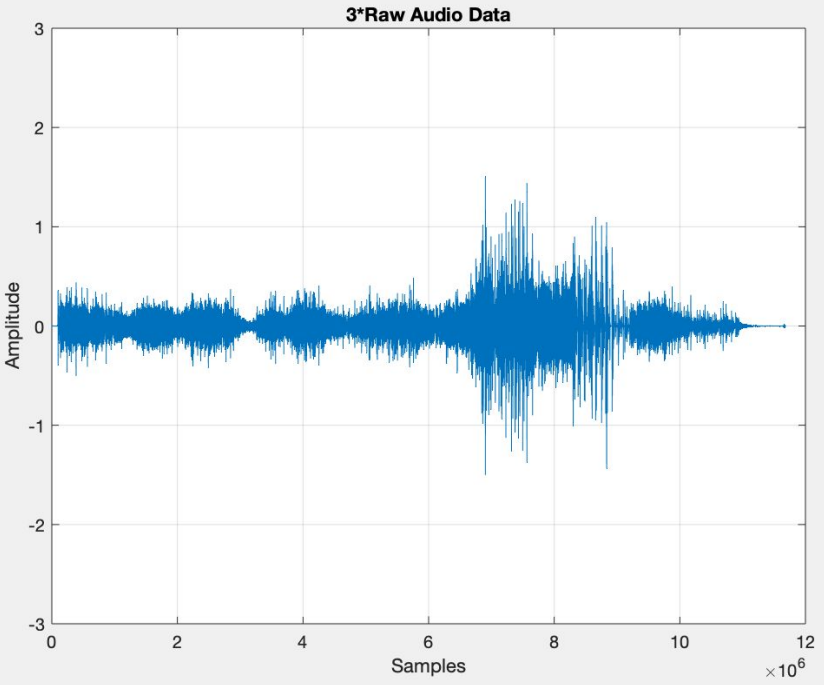

Raw Audio Data
Amplitude
Samples
×10^6
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0
2
4
6
8
10
12


Raw Audio Data
Amplitude
Samples
×10^6
3
2
1
0
-1
-2
-3
0
2
4
6
8
10
12

Scale example

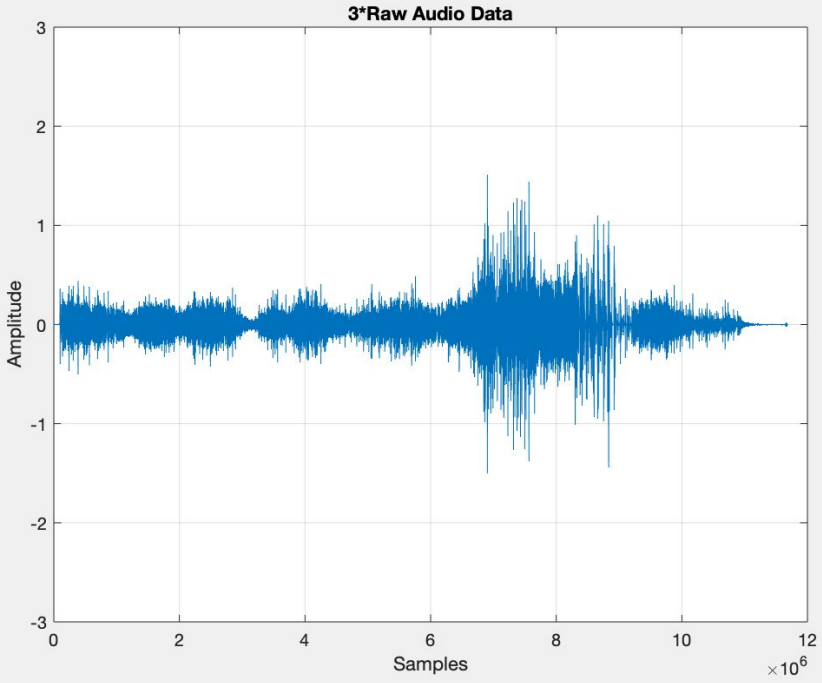
- make amplitude 3x larger

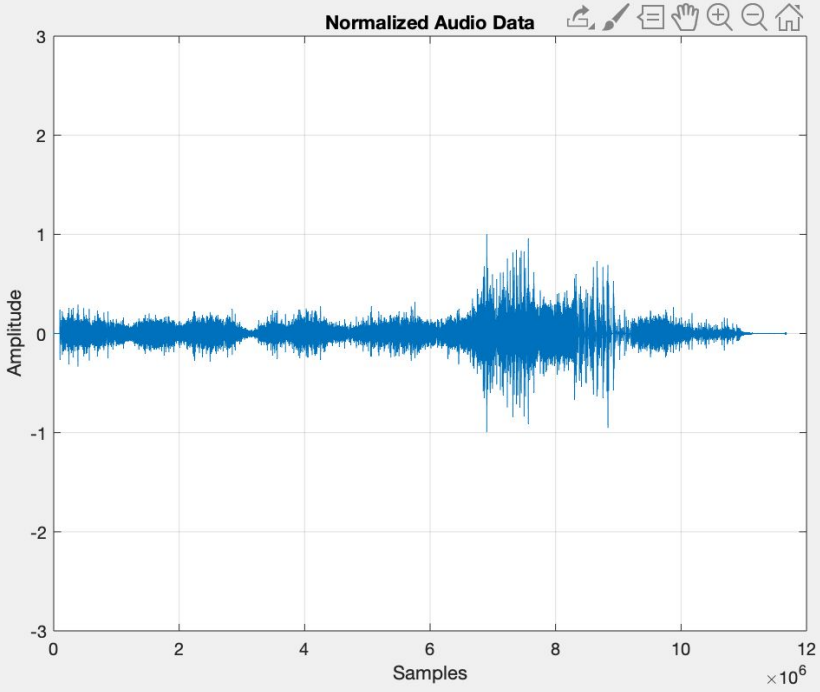




Normalization to 1

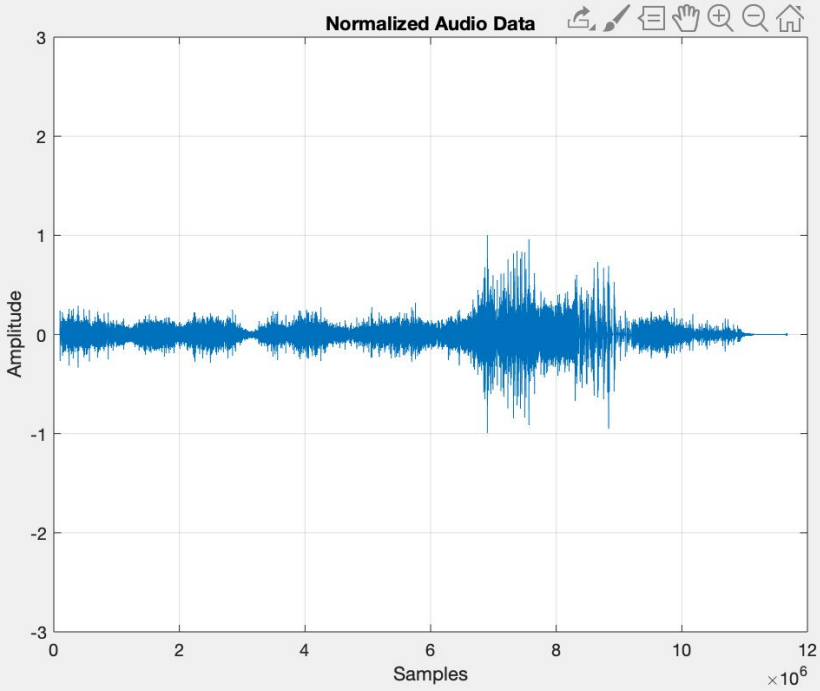
samples / max(abs(samples))

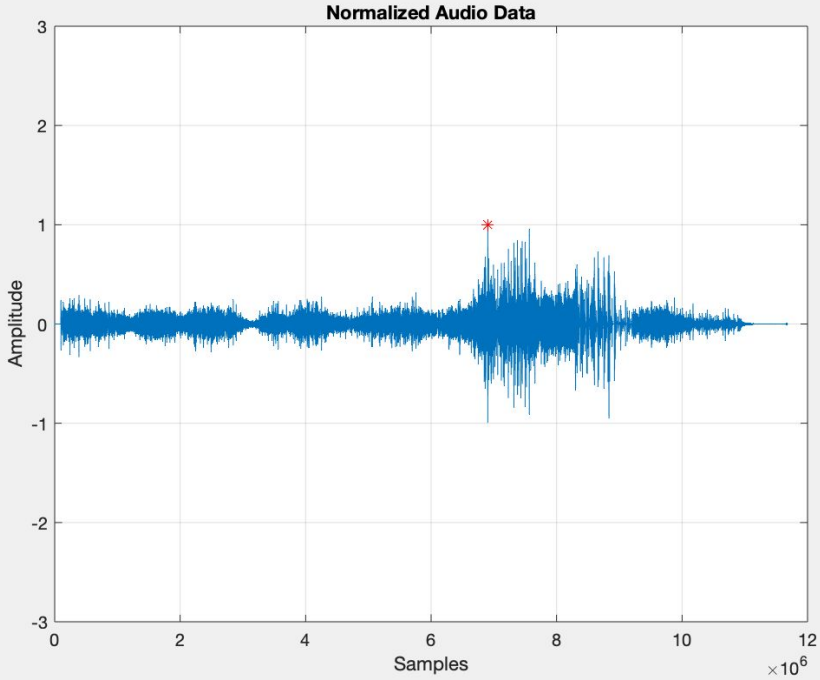




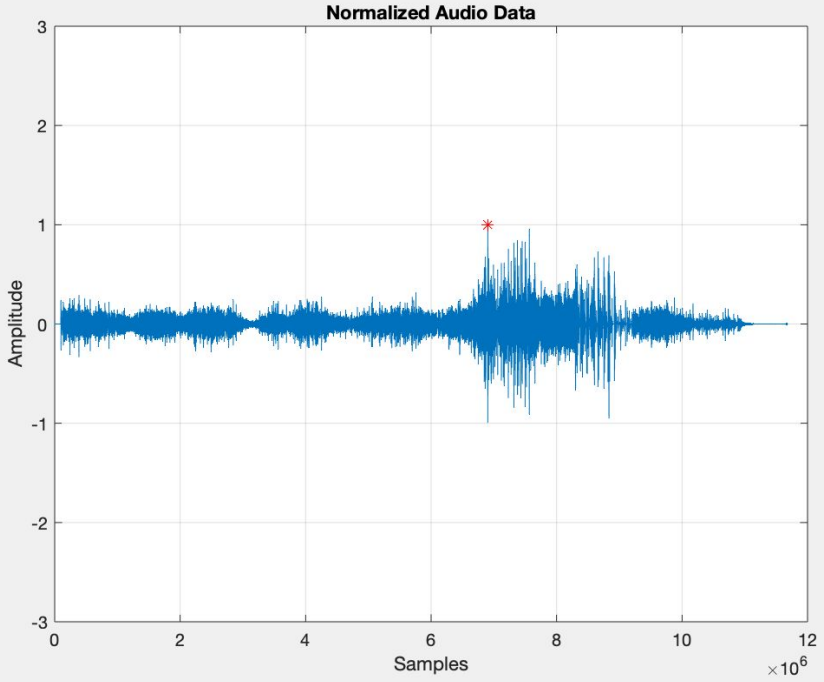
Peak detection

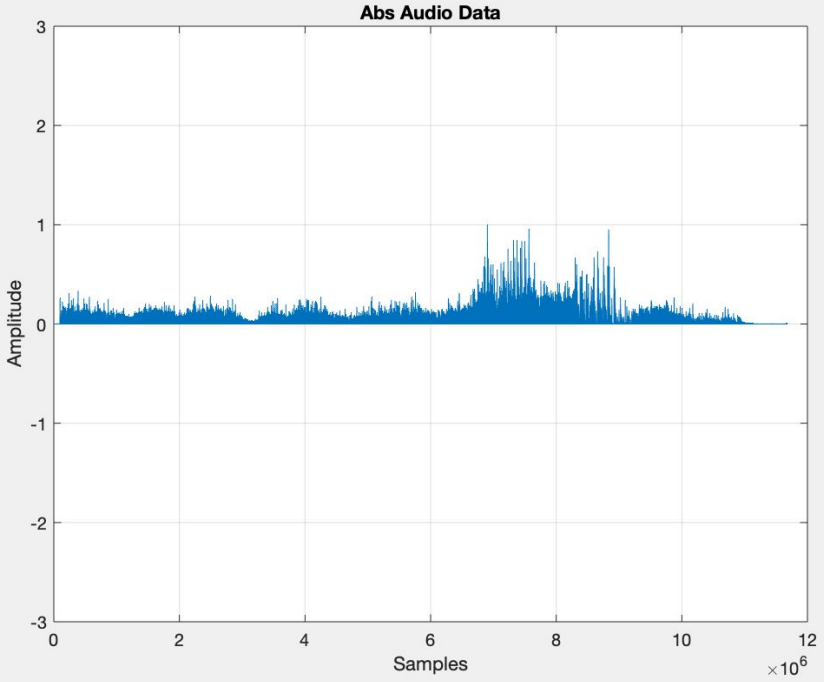
max(samples)





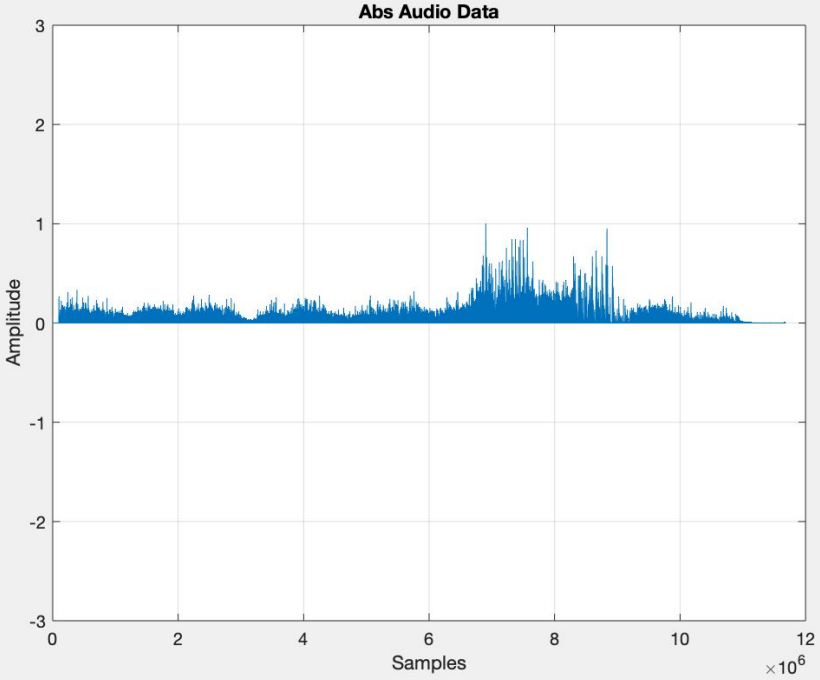
Absolute Value

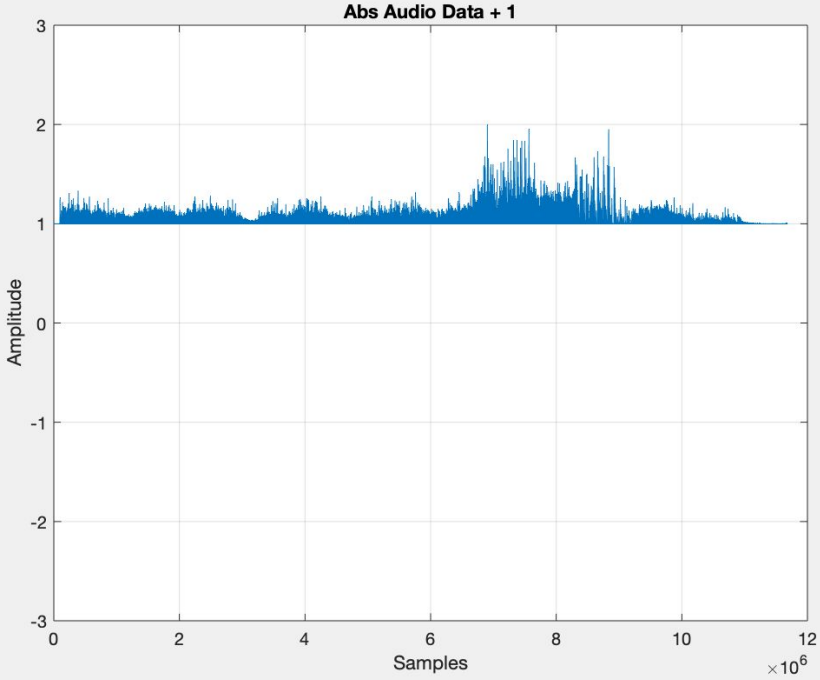




Shift (y direction)

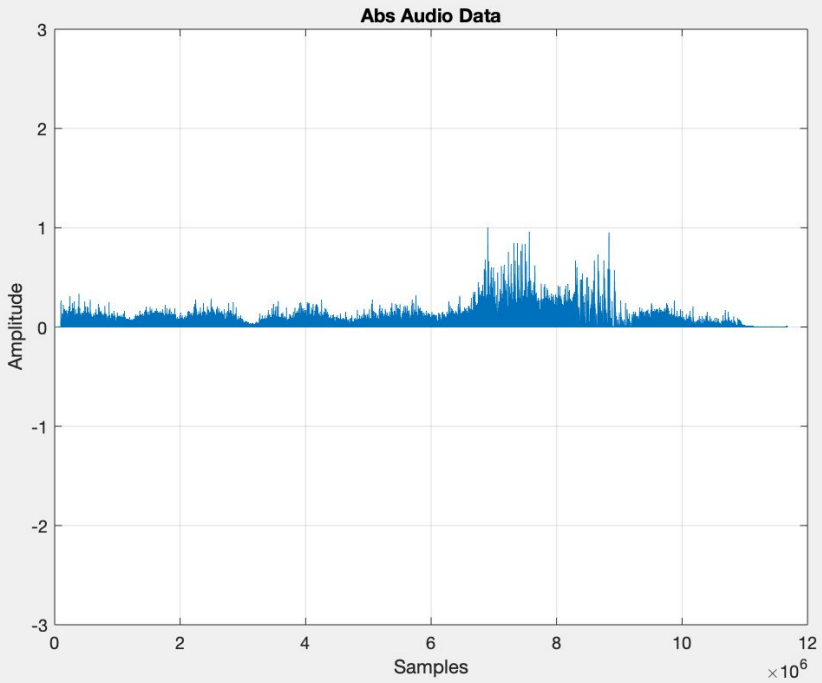
amplitudes + 1

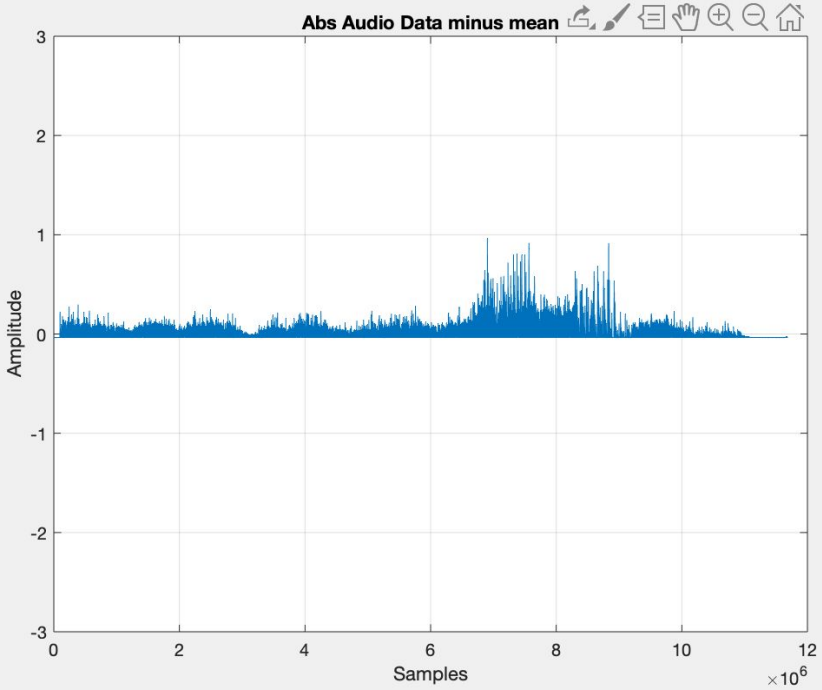




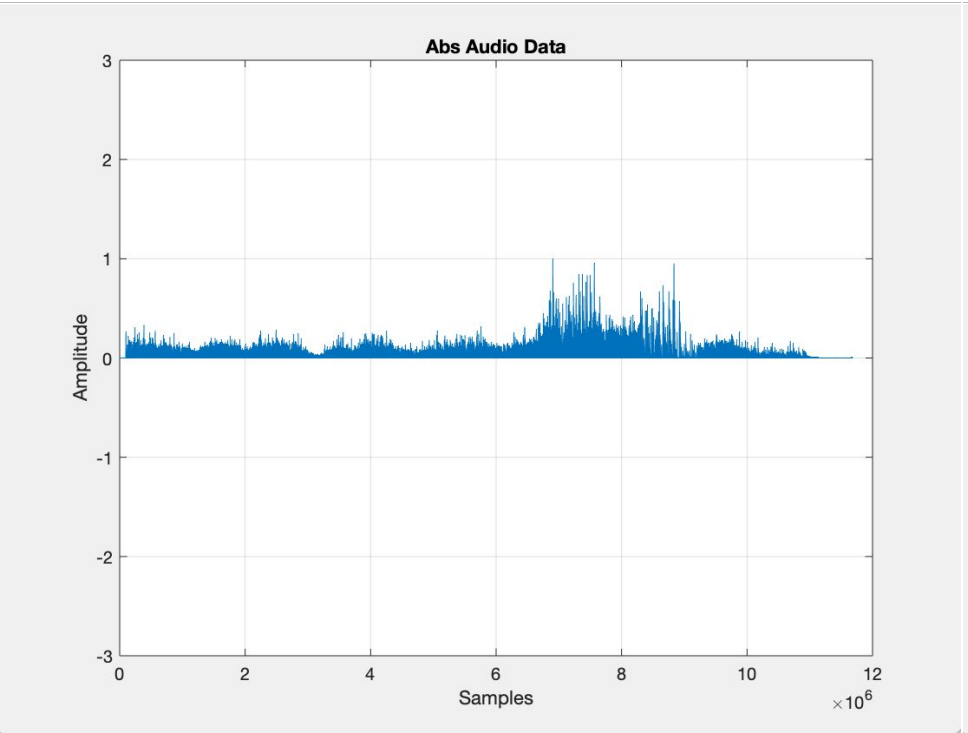
Remove mean

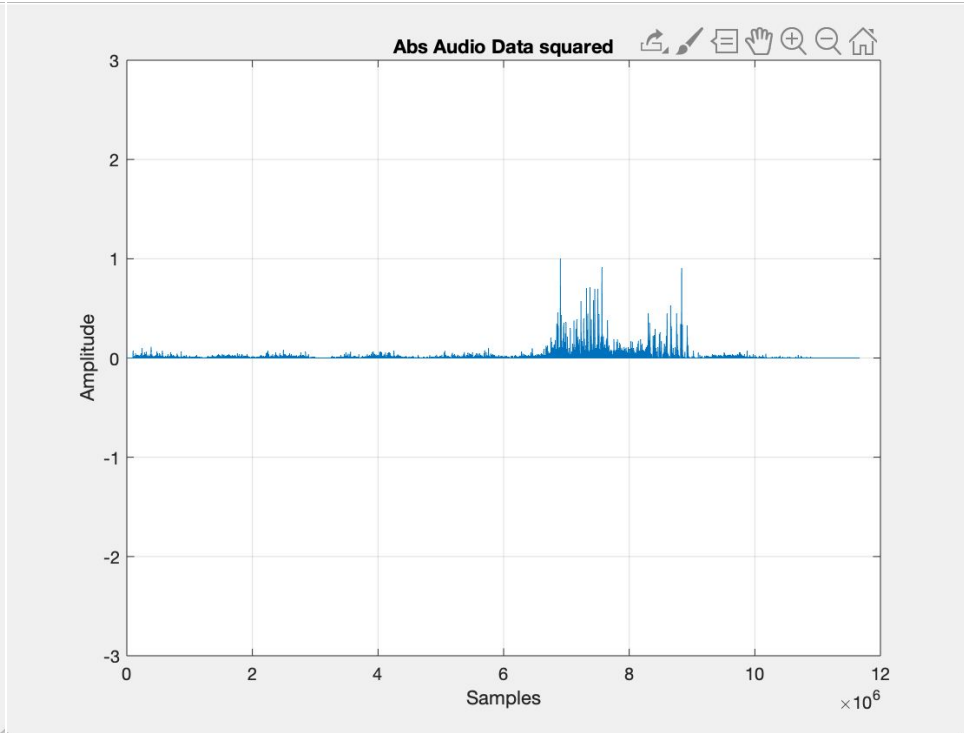
amplitudes - mean(amplitudes)



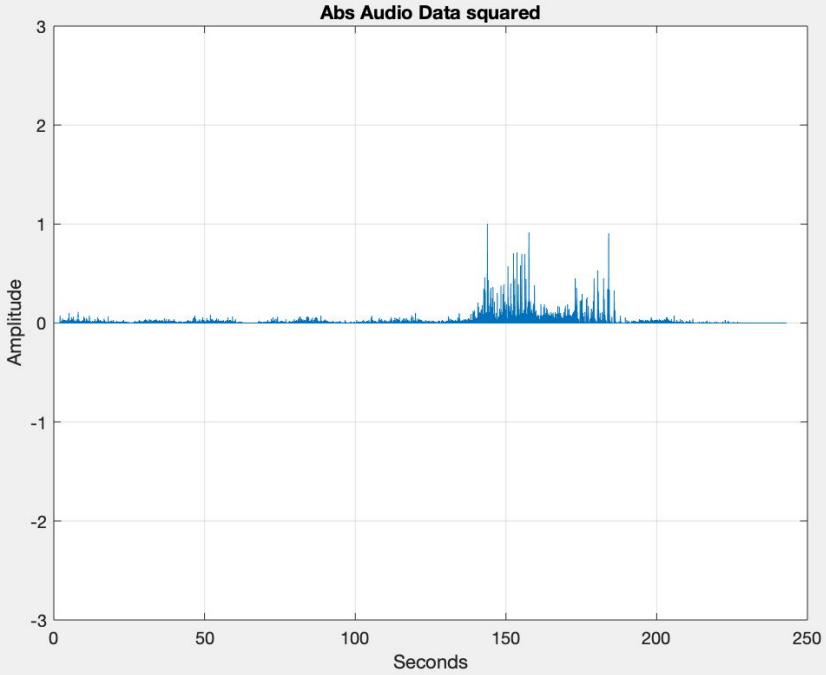


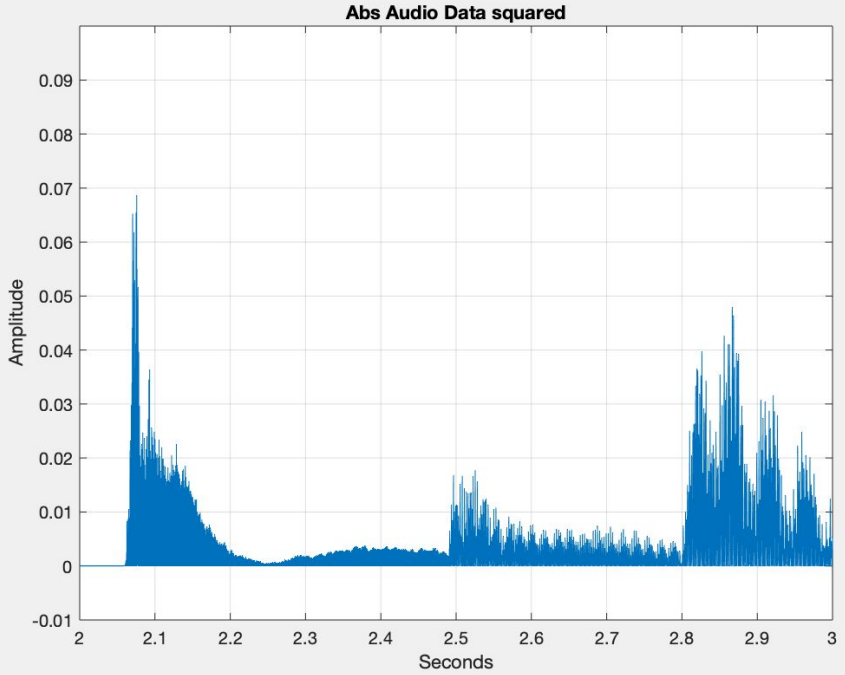
Squared


Abs Audio Data
Amplitude
Samples
×10^6
3
2
1
0
-1
-2
-3
0
2
4
6
8
10
12


Abs Audio Data squared
Amplitude
Samples
×10^6
3
2
1
0
-1
-2
-3
0
2
4
6
8
10
12

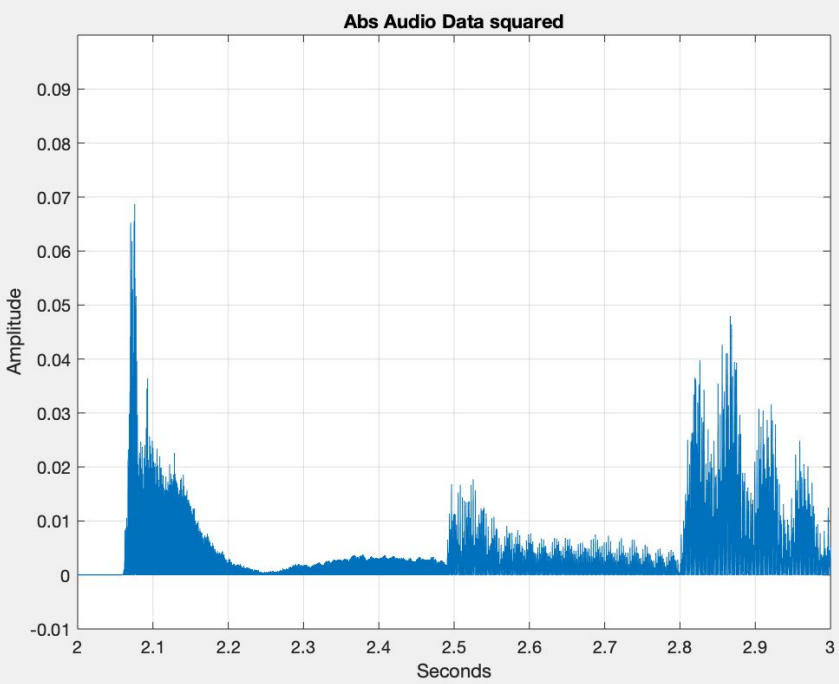
Convert to seconds, Zoom in

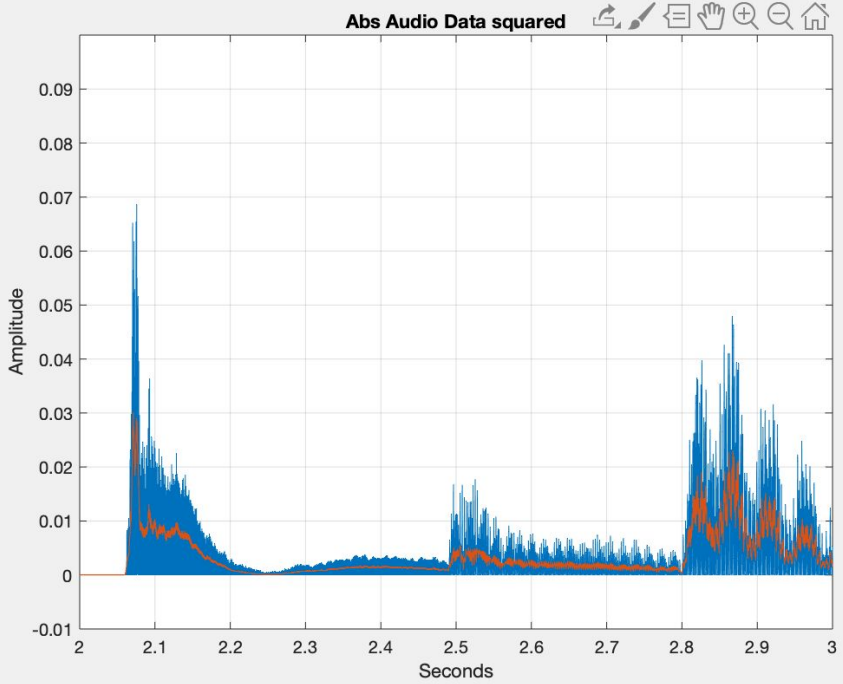




Smoothing

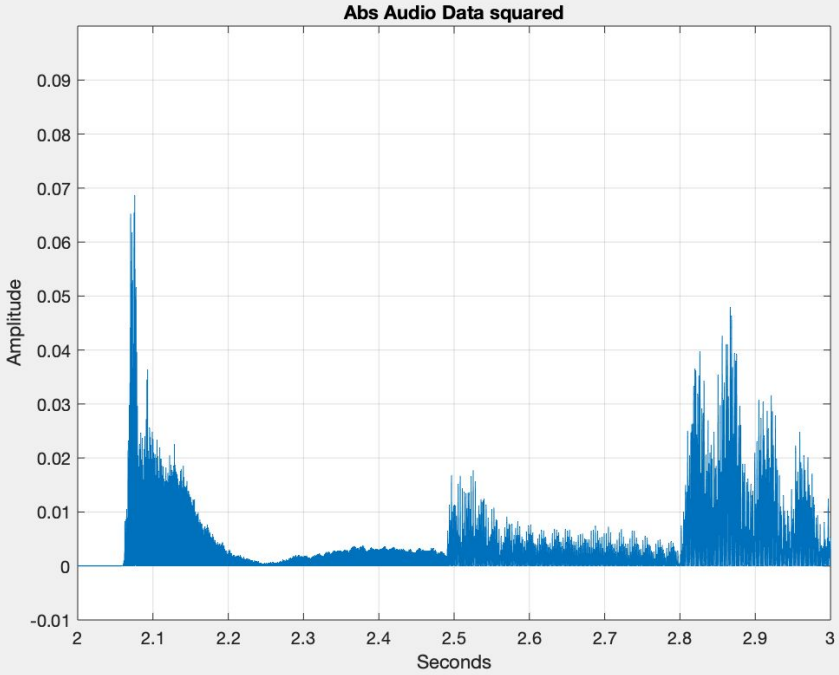
Moving average! (100 points)

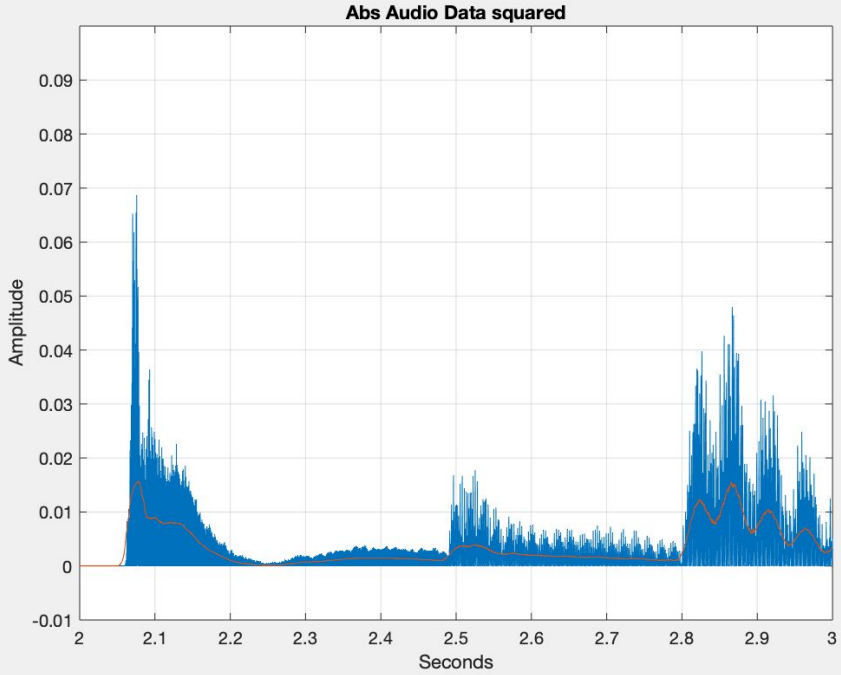




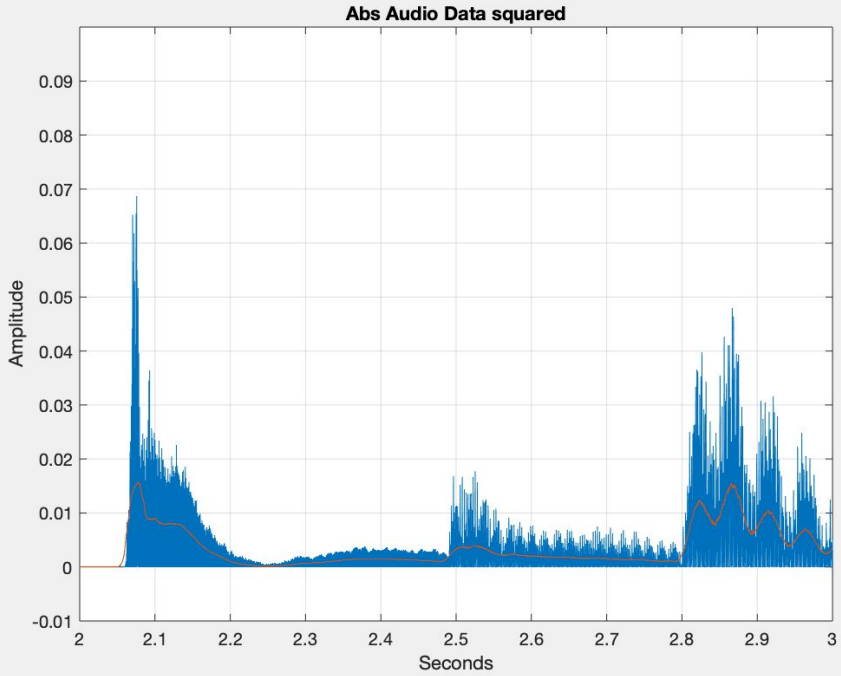
Smoothing

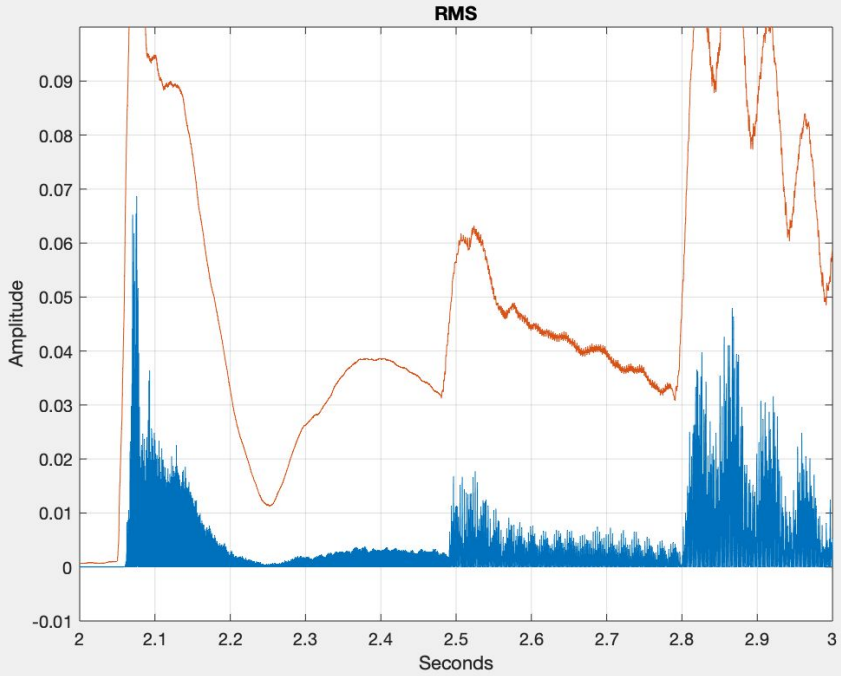
Moving average (1000 points)





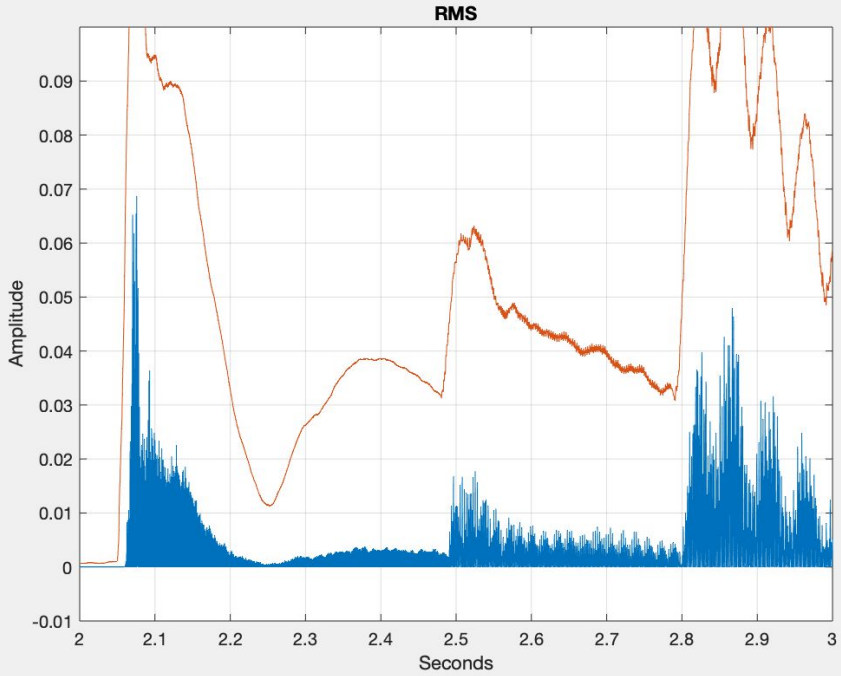
Root Mean Square (Volume)

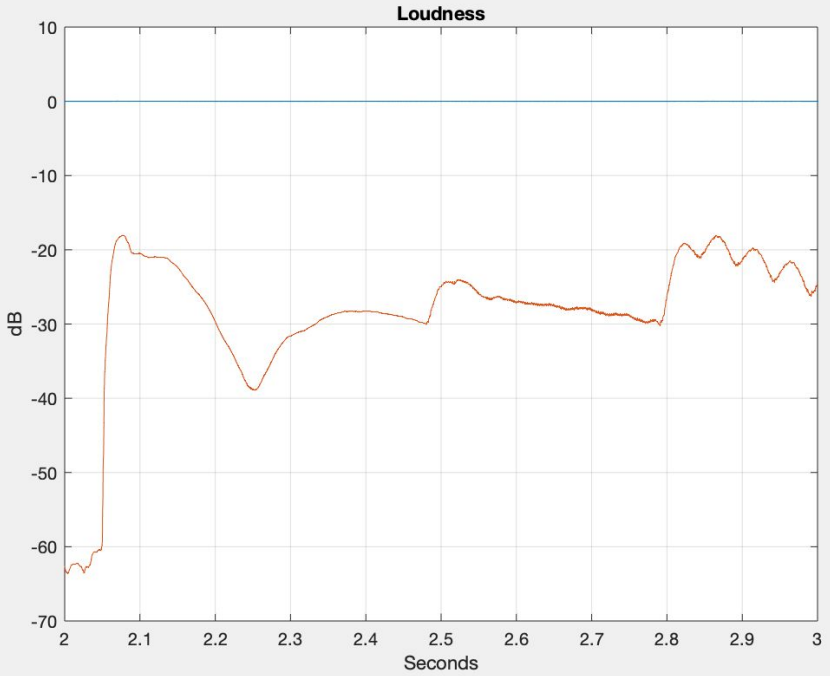




Raw Loudness

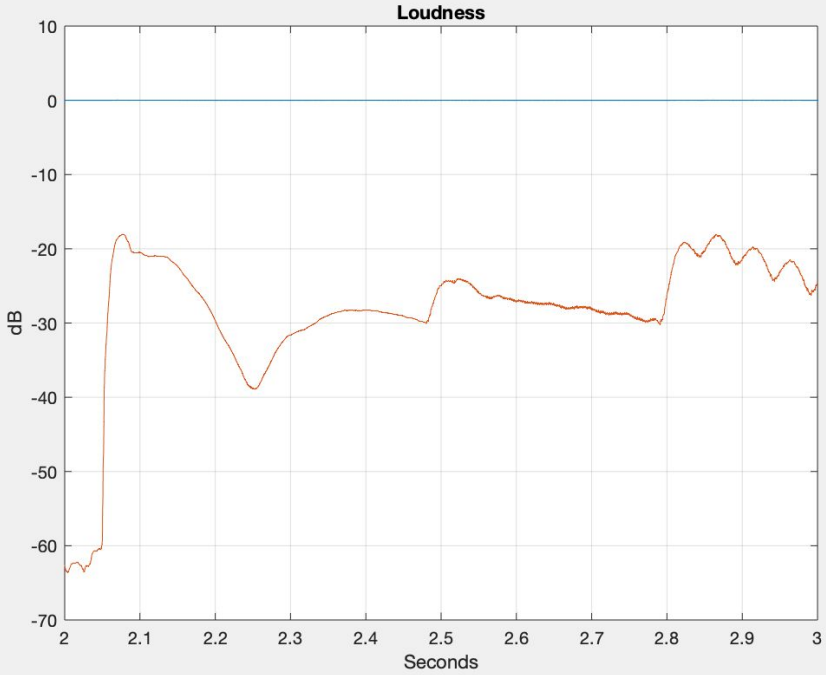
20*log10(Volume)

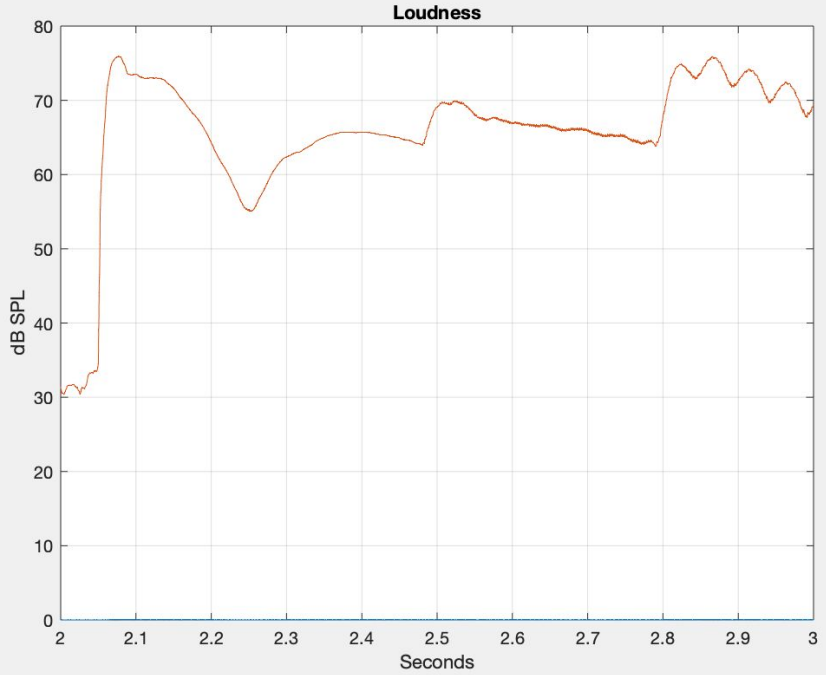




Normalized Loudness

20*log10(Volume/0.00002)

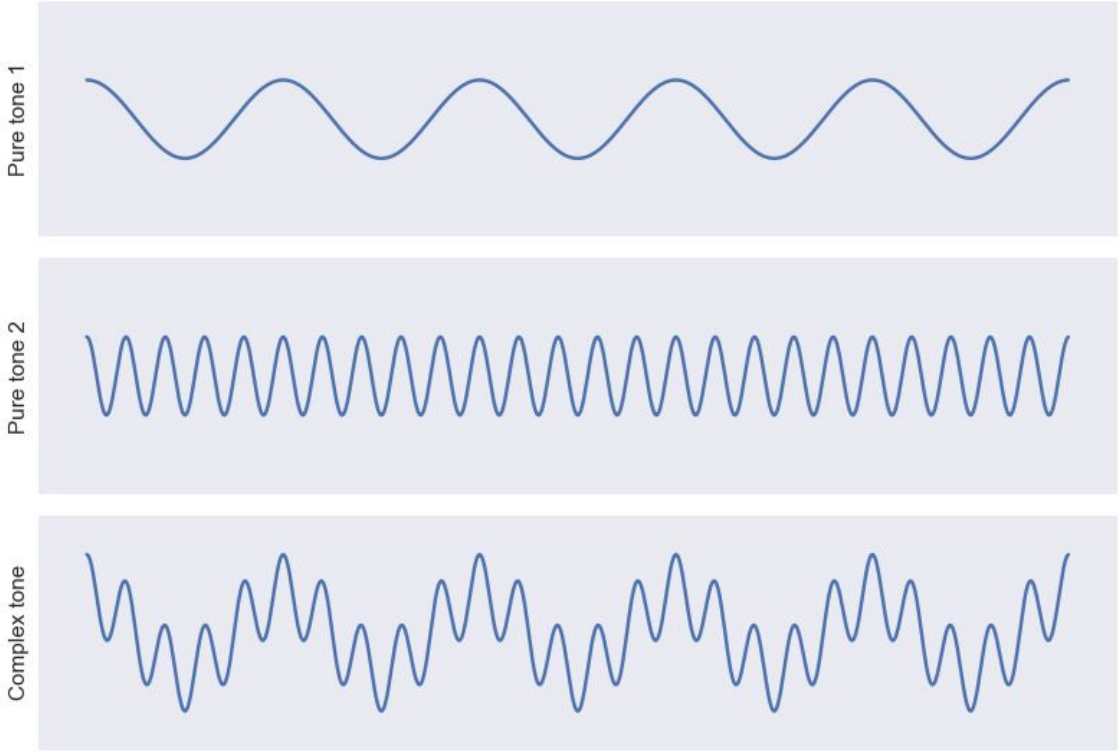




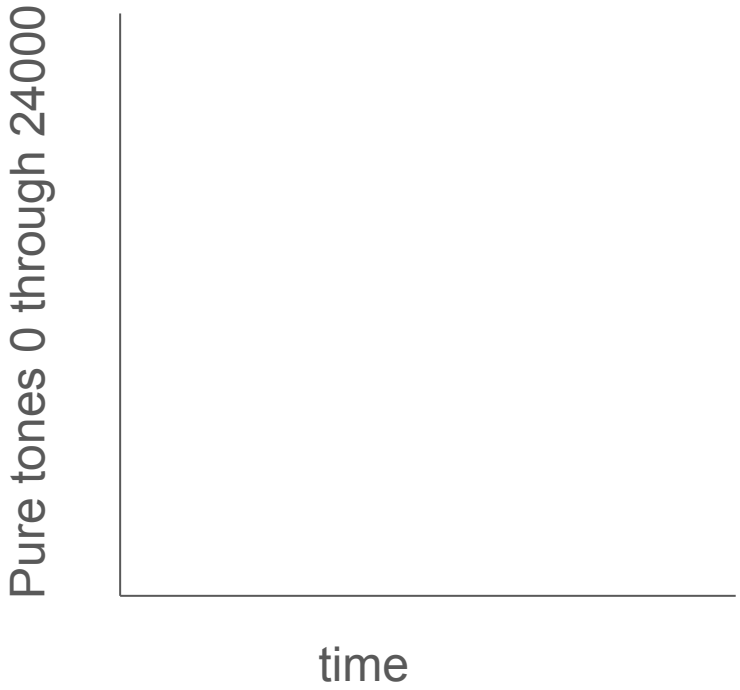
What are logarithms?

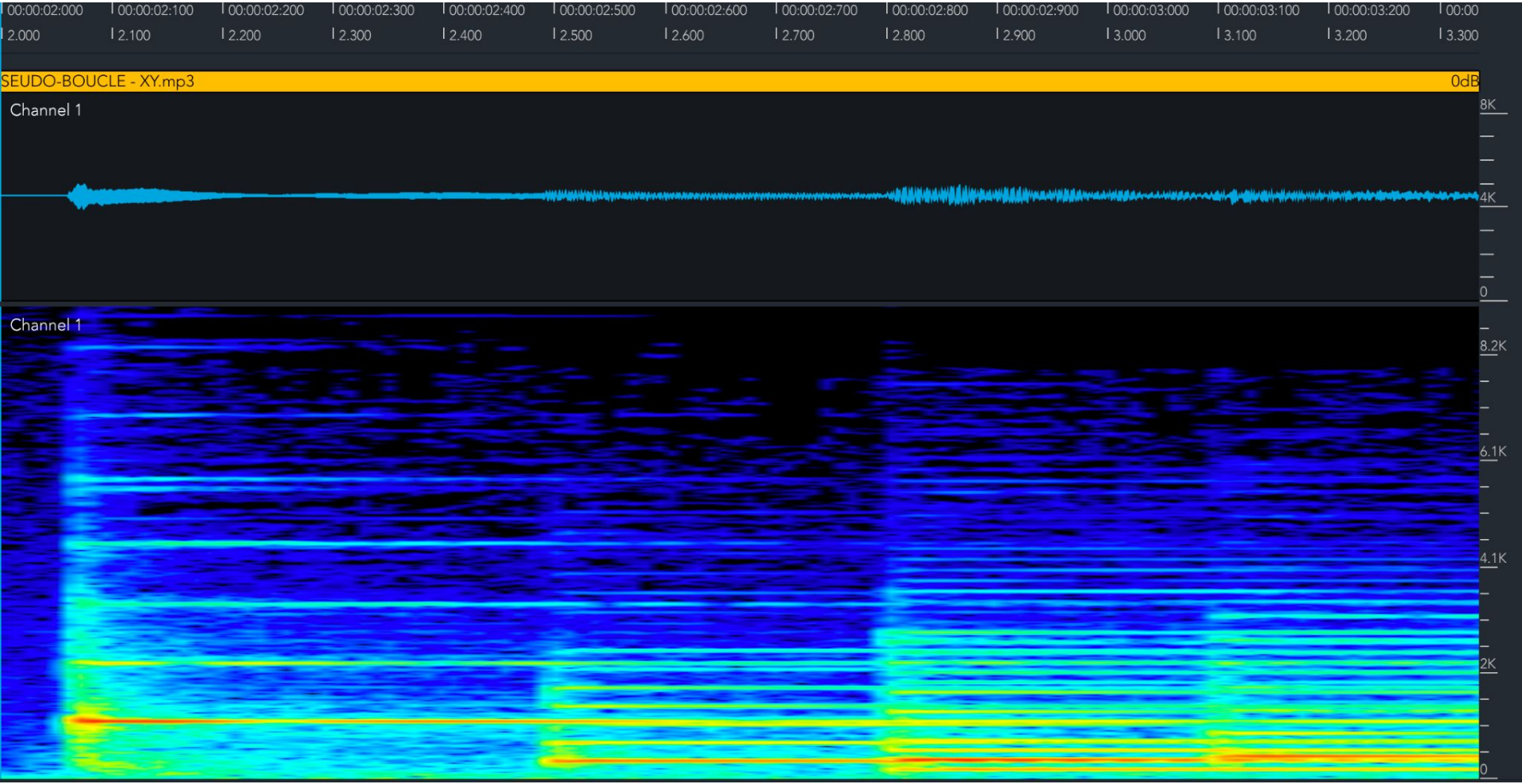
Decomposition

Fourier Transforms



Spectrogram




00:00:02:000
00:00:02:100
00:00:02:200
00:00:02:300
00:00:02:400
00:00:02:500
00:00:02:600
00:00:02:700
00:00:02:800
00:00:02:900
00:00:03:000
00:00:03:100
00:00:03:200
00:00
2.000
2.100
2.200
2.300
2.400
2.500
2.600
2.700
2.800
2.900
3.000
3.100
3.200
3.300
SEUDO-BOUCLE - XY.mp3
0dB
Channel 1
8K
4K
0
Channel 1
8.2K
6.1K
4.1K
2K
0