DSP | Audio Handling |Assignment 3

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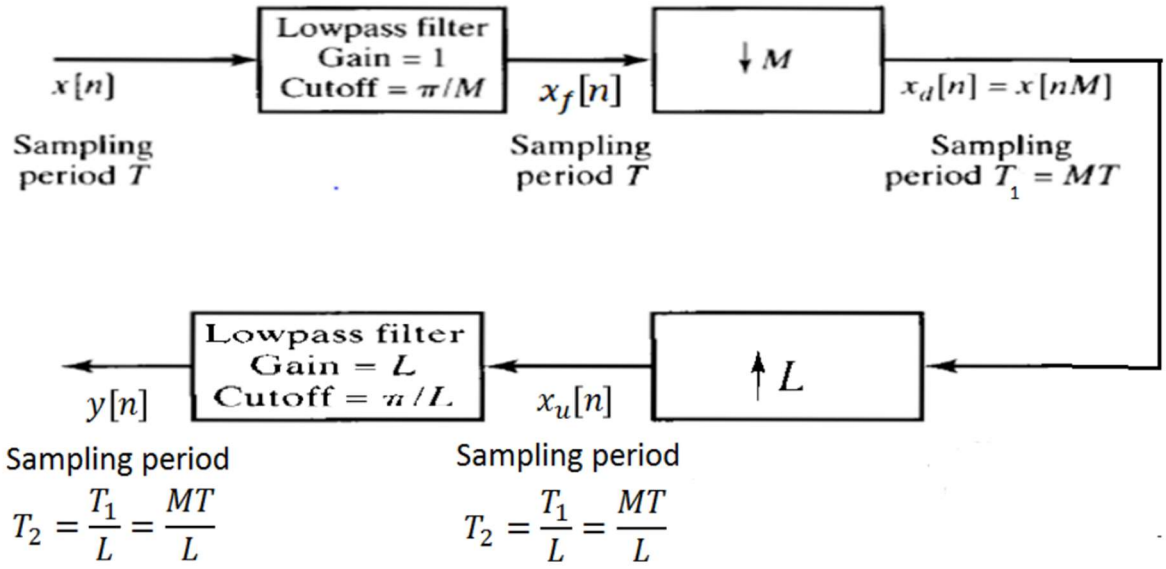
Aim: Audio Signal Decimation & Interpolation

System Block Diagram:



Procedure:

1. Given audio file is loaded into environment using “audioread()”
2. Specify values for M, L and calculate cutoff frequency “fc”
3. Using previously designed decimator and interpolator function, pass audio samples and factors and save decimated & interpolated output using “audiowrite()”
4. Get decimated and interpolated spectrograms for M = L = [2,4,8]

Observations:

1. As the factor values increases from M=L=2 to M=L=8, higher frequencies are getting clipped off and hence there is a significant decrease in audio quality after decimation & interpolation.
2. From original spectrogram, we can say given audio signal has frequencies up to 10KHz.
3. For M=L=2, Cutoff frequency = sampling frequency / 4 = 5512 Hz
4. For M=L=4, Cutoff frequency = sampling frequency / 8 = 2756 Hz
5. For M=L=8, Cutoff frequency = sampling frequency / 16 = 1378 Hz
6. The above cutoff frequencies are clearly visible on output spectrograms for each factor.

Spectrograms:

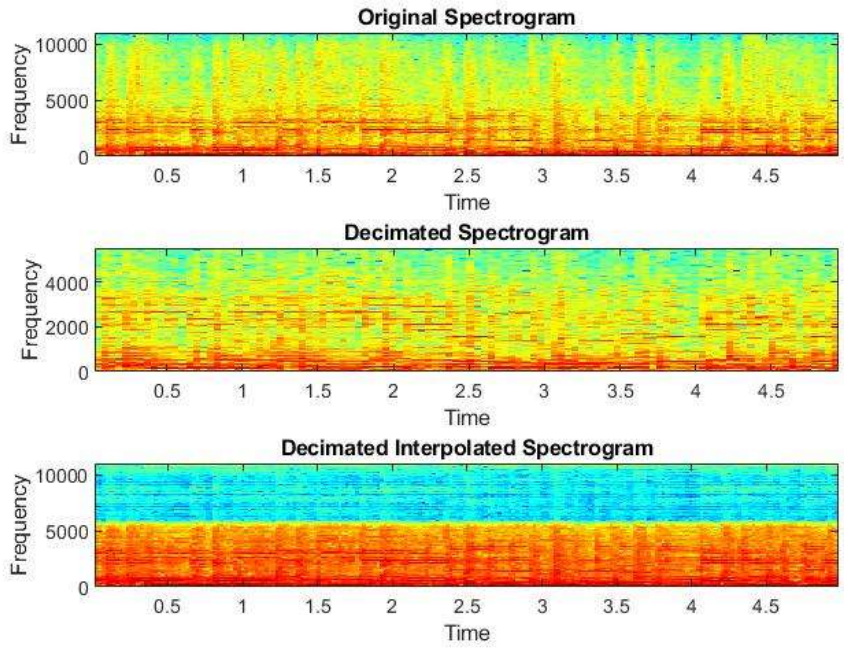


Figure 1:M=L=2

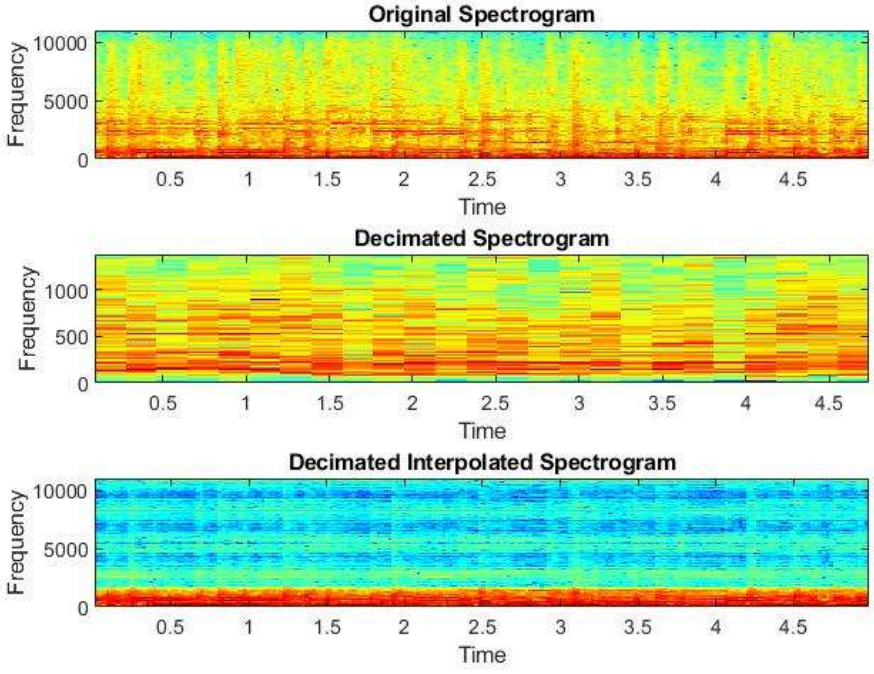


Figure 2: M=L=8

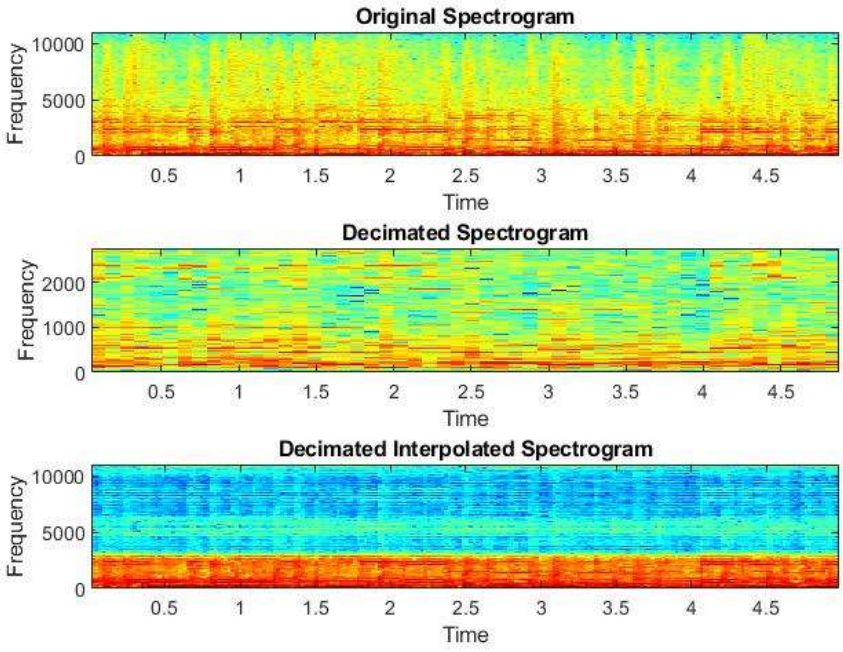

Original Spectrogram
Frequency
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Time
Decimated Spectrogram
Frequency
2000
1000
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Time
Decimated Interpolated Spectrogram
Frequency
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Time

Figure 3: M=L=4