AUDIO FILTERING ASSIGNMENT

EE23BTECH11011- Batchu Ishitha*

I. DIGITAL FILTER

I1. The sound file used for this code can be obtained from the following link.

I2. Python code for removal of out of band noise:

```
import soundfile as sf
from scipy import signal

# read.wavfile
input_signal,fs=sf.read('ishitha.wav')

#sampling frequency of input signal
sampl_freq=fs

#order of the filter
order=4

#cutoff frequency
cutoff_freq=10000.0


#digital frequency
Wn=2*cutoff_freq/sampl_freq

#b and a are numerator and denominator
     polynomials respectively
b,a=signal.butter(order,Wn,'low')

#filter the input signal with butterworth filter
output_signal=signal.filtfilt(b,a,input_signal,
     padlen=1)

#output_signal=signal.lfilt(b,a,input_signal)

#write the output signal into .wav file
sf.write('ishithareducednoise.wav',
     output_signal,fs)
```

I3. Analysis of sound file before and after removal of noise using spectrogram ie: https://academo.org/demos/spectrum-analyzer.

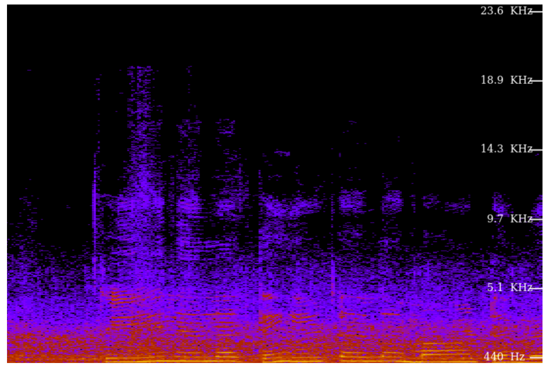

Fig. I.3. Spectrogram of the audio file before Filtering

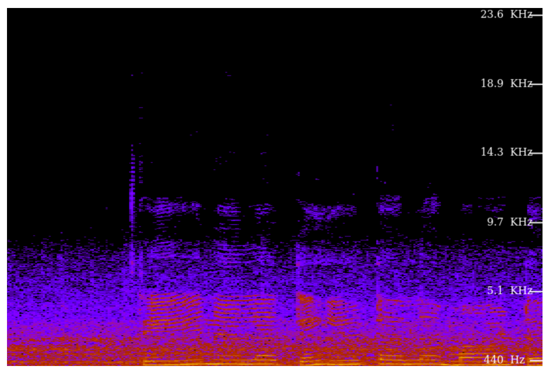

Fig. I.3. Spectrogram of the audio file after Filtering

II. DIFFERENCE EQUATION

II1. Let

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \tag{1}$$

Sketch $x(n)$.

II2. Let

$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2), \quad y(n) = 0, n < 0 \tag{2}$$

Solution: C code for generating values of y(n):

Python code for plotting x(n) and y(n):

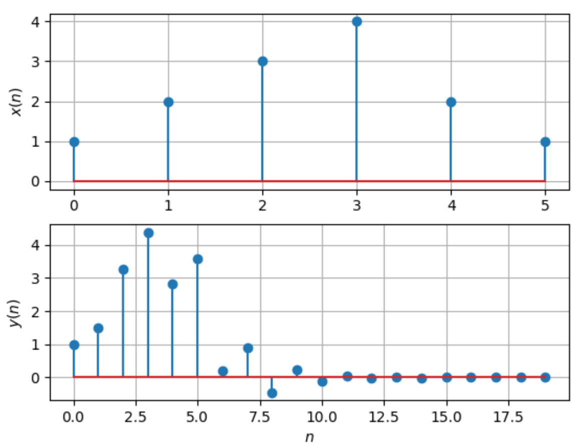

Fig. 2. Plot of $x(n)$ and $y(n)$