DSP Assignment 2

ECE16U017

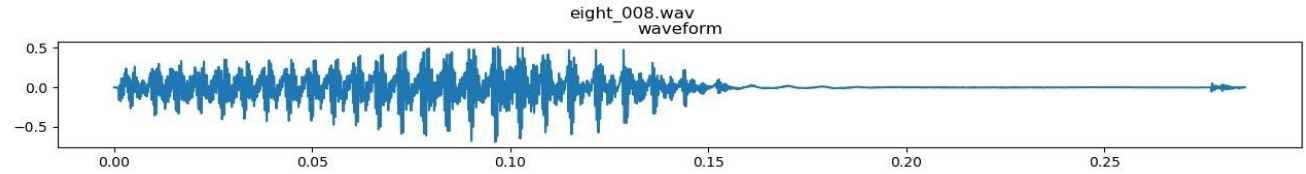
The calculation of MFCC and plotting the spectrograph
Done on PYTHON

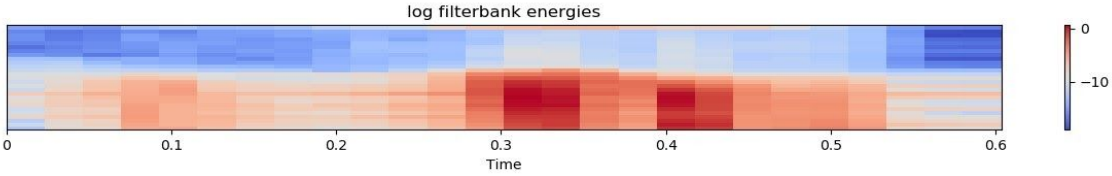
CODE

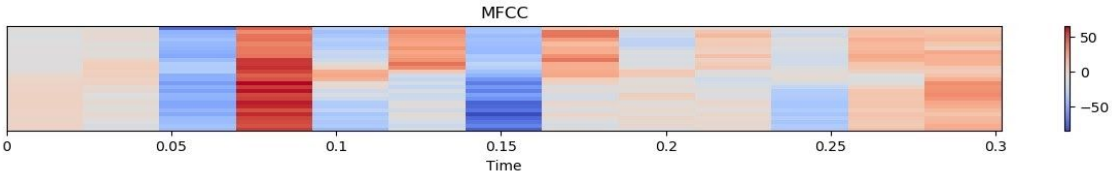
```
import librosa
import librosa.display as ld
import python_speech_features as psf
import matplotlib.pyplot as plt
import numpy as np
import os
path = "C:\\Users\\rhin1\\Downloads\\DSP\\Assign 2\\Wavs"
j = 1
for i in os.listdir(path):
    name = os.path.join(path,i)
    y,sr = librosa.load(name) #Load Wav
    lfe = psf.logfbank(y,sr,nfft = 1024)  # Log filterbank energies
    mfcc = psf.mfcc(y,sr,nfft = 1024, winfunc=np.hamming) # MFCC
    time = np.linspace(0, len(y) / sr, num=len(y)) #To plot waveform wrt
Time
    plt.figure(j)
    plt.suptitle(i)
    j = j+1
    plt.subplot(3,1,1)
    plt.title('waveform')
    plt.plot(time,y)
    plt.subplot(3,1,2)
    plt.title('log filterbank energies')
    ld.specshow(lfe, x_axis = 'time')
    plt.colorbar()
    plt.tight_layout()
    plt.subplot(3,1,3)
    plt.title('MFCC')
    # mfcc = np.swapaxes(mfcc,0,1)
    ld.specshow(mfcc, x_axis = 'time')
```

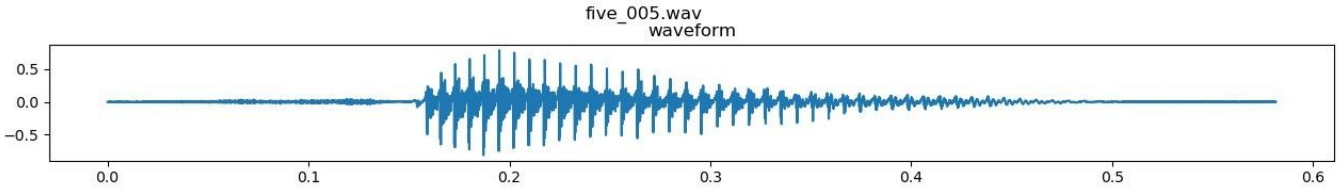
```
    plt.colorbar()
    plt.tight_layout()
plt.show()
```

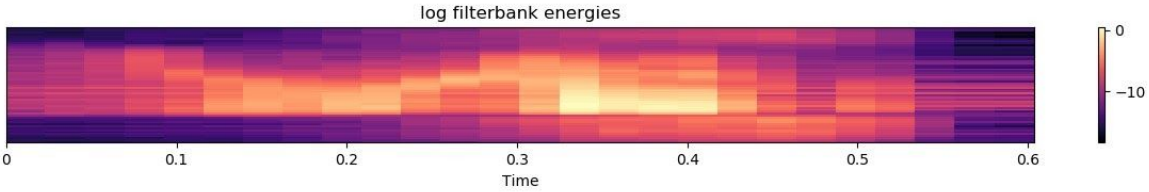
WAVEFORM

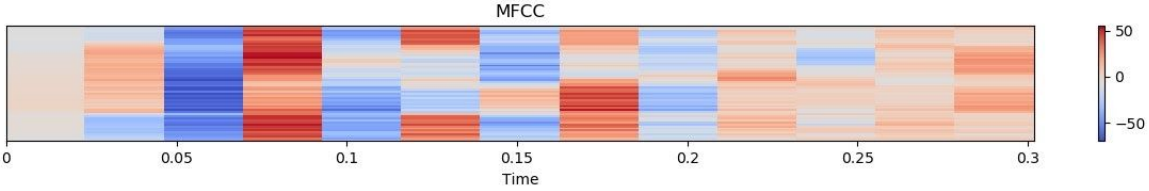


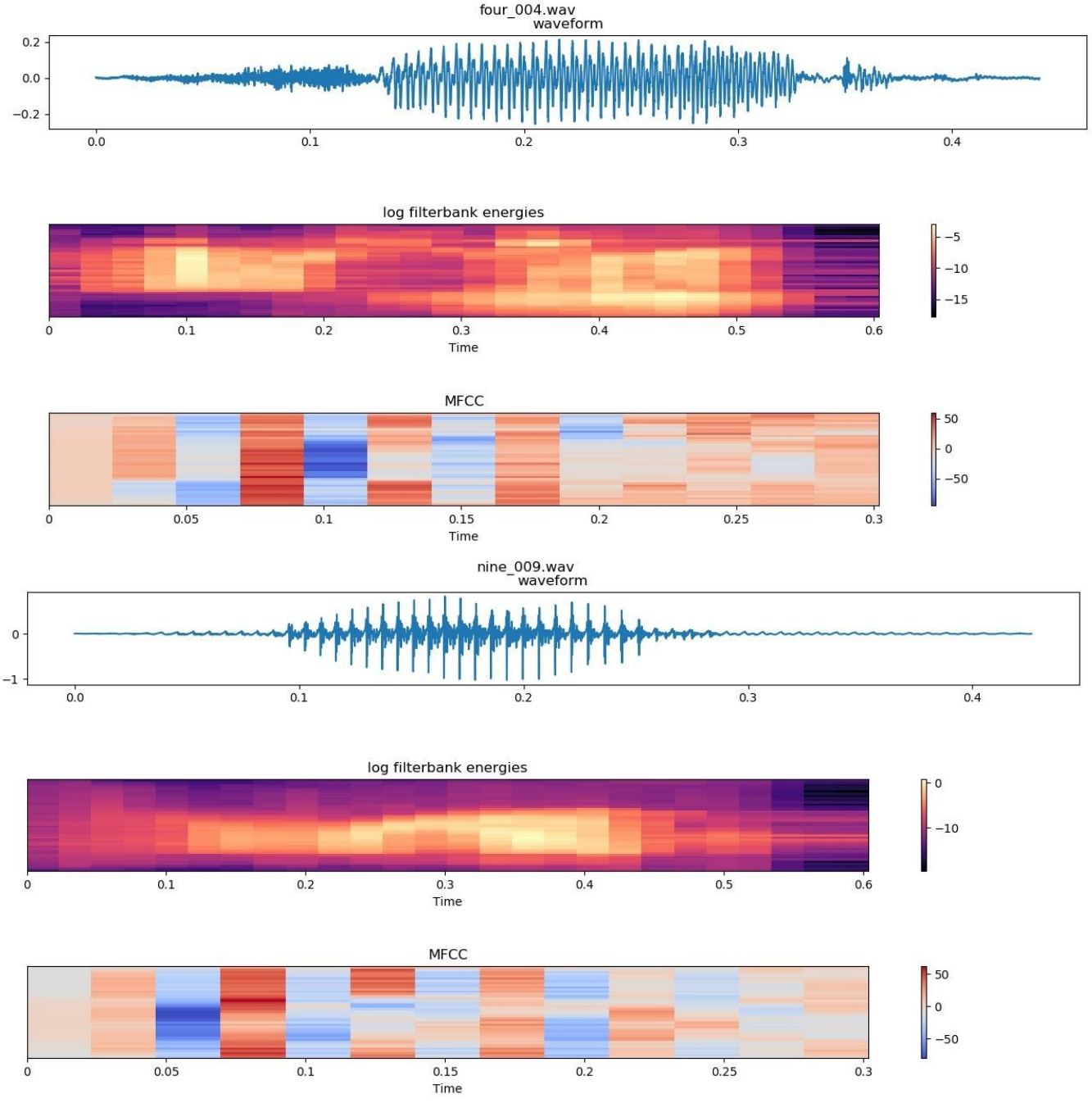


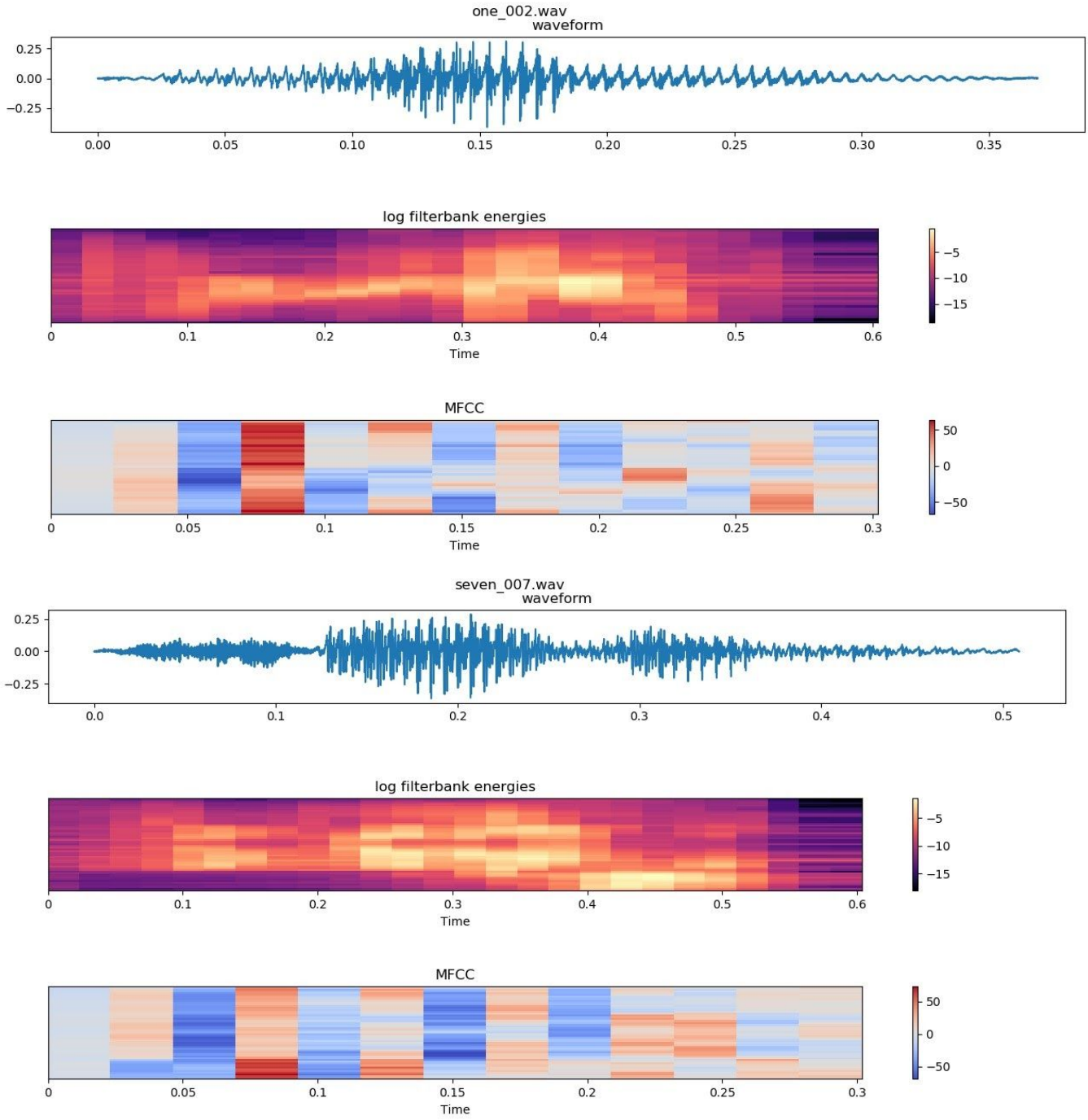


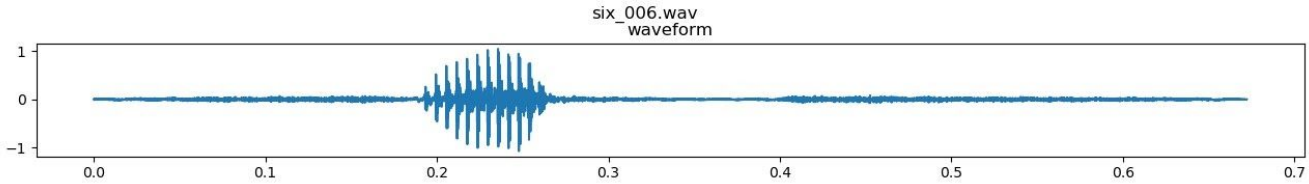


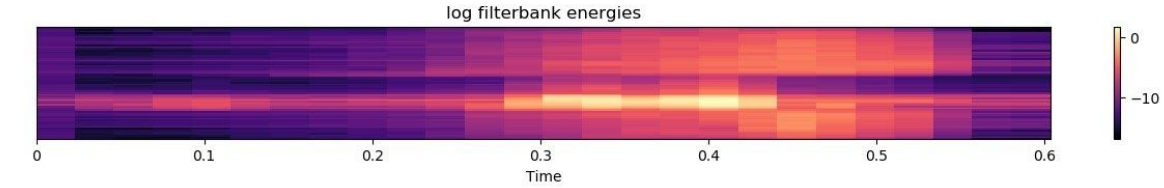


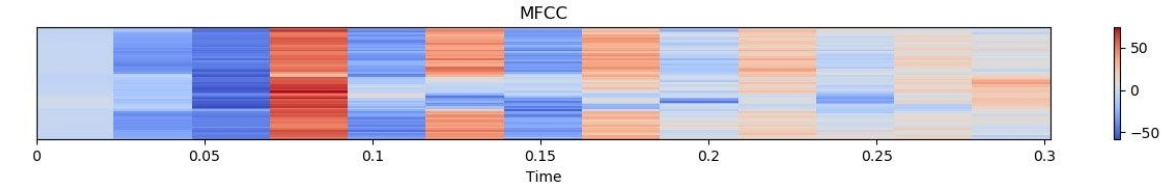


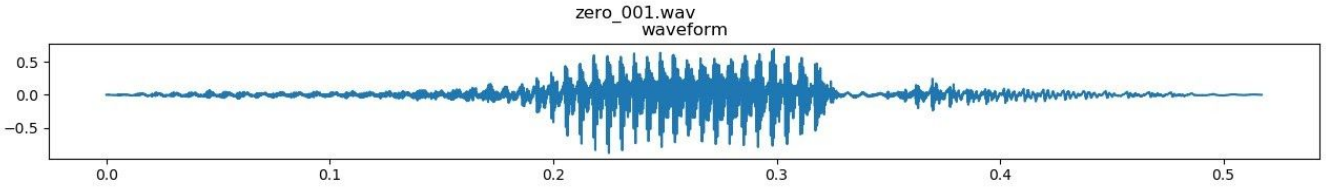

four_004.wav
waveform
log filterbank energies
Time
MFCC
Time
nine_009.wav
waveform
log filterbank energies
Time
MFCC
Time

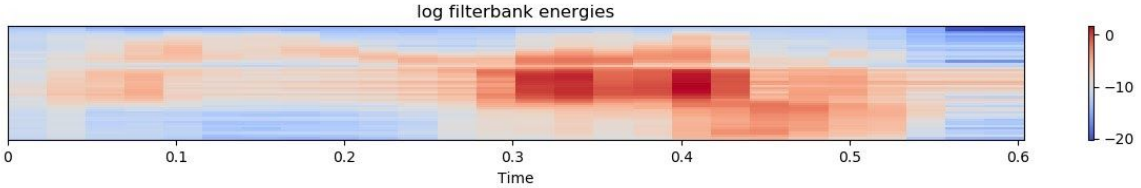

one_002.wav
waveform
0.25
0.00
−0.25
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
log filterbank energies
−5
−10
−15
0
0.1
0.2
0.3
0.4
0.5
0.6
Time
MFCC
50
0
−50
0
0.05
0.1
0.15
0.2
0.25
0.3
Time
seven_007.wav
waveform
0.25
0.00
−0.25
0.0
0.1
0.2
0.3
0.4
0.5
log filterbank energies
−5
−10
−15
0
0.1
0.2
0.3
0.4
0.5
0.6
Time
MFCC
50
0
−50
0
0.05
0.1
0.15
0.2
0.25
0.3
Time

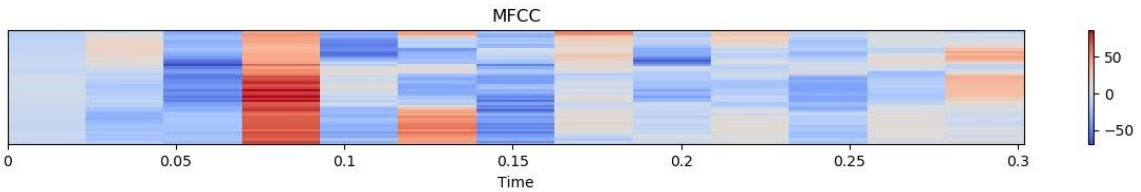

six_006.wav
waveform

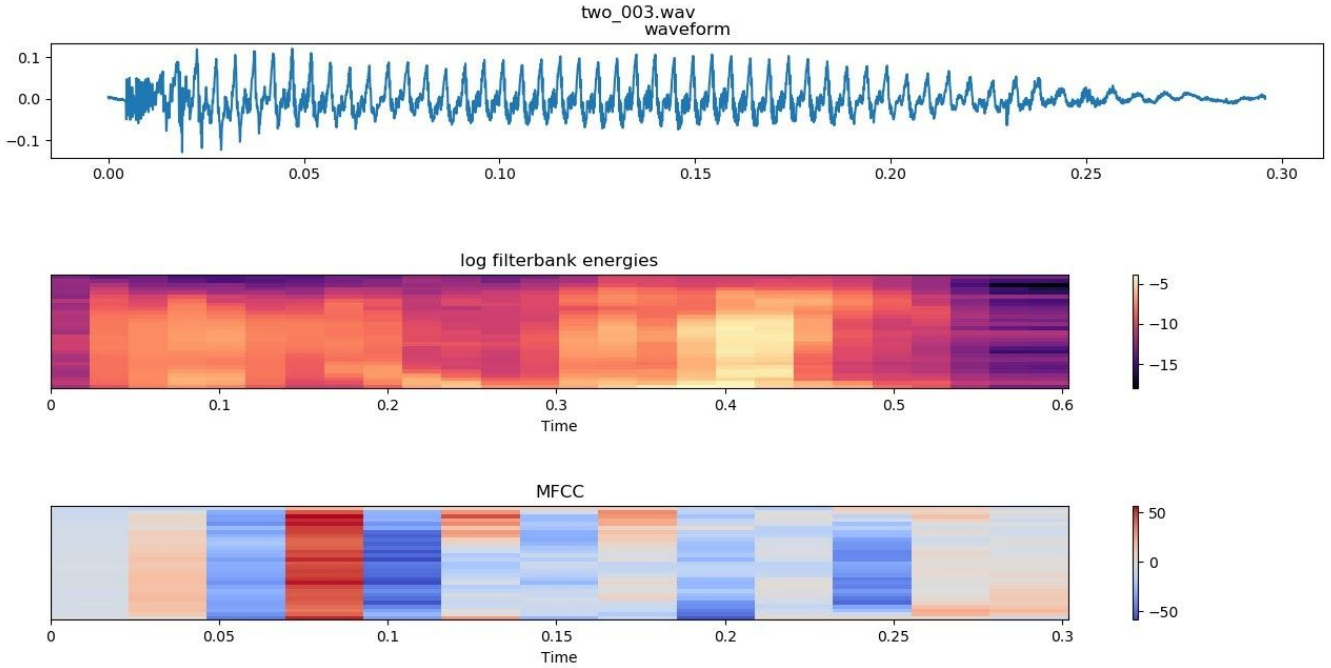

log filterbank energies
Time


MFCC
Time


zero_001.wav
waveform


log filterbank energies
Time


MFCC
Time


two_003.wav
waveform
0.1
0.0
−0.1
0.00
0.05
0.10
0.15
0.20
0.25
0.30
log filterbank energies
−5
−10
−15
0
0.1
0.2
0.3
0.4
0.5
0.6
Time
MFCC
50
0
−50
0
0.05
0.1
0.15
0.2
0.25
0.3
Time