National Institute of Technology Calicut

Department of Electronics and Communication Engineering

EC 3093D DIGITAL SIGNAL PROCESSING LAB

Sixth Semester B Tech Electronics & Communication Engineering

Experiment 6: Image and Audio processing - Basic operations (Matlab and Python Implementation).

Note: All the experiments must be implemented in both Matlab and Python.

Audio Processing

1. Use the function audioread from matlab (In python use Librosa library to read and write the wav files) to read the file $Sound\_1.wav$. This defines a signal x as well as the sampling rate Fs . If the signal is stereo then, only use the first channel

2. Initialize a length parameter $N = 4096$ and a hop size parameter $H = 2048$

3. Define a window function w of length N (using hann)

4. Compute χ using the function S=spectrogram(X,WINDOW,NOVERLAP). To this end, one needs to compute the window overlap from N and H. The matrix S contains the complex-valued Fourier coefficients $\chi(m, k)$.

5. Compute the spectrogram Y(m, k) as in given equation
   $Y(m, k) = |\chi(m, k)|^2$

6. Using equation (2) [1], compute a vector T that contains the physical time positions (in seconds) of the time indices

7. Using equation (3) , compute a vector F that contains the frequency values (in Hertz) of the frequency indices

[1] For equation(2) and (3), refer the pdf attached

8. Visualize the spectrogram in various ways using the functions image, imagesc, axis xy, colorbar, and so on. Doing so, also get familiar with the various visualization parameters and tools offered by MATLAB

9. Plot the spectrogram with the axis given in seconds and Hertz. This should be done by applying the functions image or imagesc using T and F as additional parameters

10. Use a logarithmic decibel-scale for visualizing the values Y(m, k). (Recall that, given a value v ϵ R, the decibel value is $10log_{10}(v)$.)

11. Compute spectrograms using different window sizes.
(for example,$N\epsilon\{256, 1024, 4096, 8192\}$) and different hop sizes (for example, $H\epsilon\{1, N/4, N/2\}$).

12. Discuss the trade-off between time resolution and frequency resolution

13. Try out with Speech_paris.wav file also
