

EE-414 Speech Processing Lab

Lab-7

AIM

- To understand the limitation of DTFT for the spectral analysis of speech.
- To understand the development of short-term Fourier transform (STFT) representation.
- To understand the difference in the nature of linear and log magnitude spectra.
- To understand the difference among the spectra of voiced, unvoiced and silence regions of speech.
- To plot the STFT of a speech signal.
- To understand the difference between true and convolved spectra.
- To understand the effect of rectangular, Hamming and Hanning window functions on short term spectral analysis.
- To understand the effect of frame size on short term spectral analysis

PROBLEM STATEMENT

Record (16kHz, 16bit) the word “**speech signal**”; truncate long silence regions.

- A. DTFT of and its limitation:
 - a. Plot the linear and log magnitude spectrum for the entire speech.
 - b. Plot log-magnitude spectrum of voiced, unvoiced and silence regions in the recorded speech and explain the difference between log-spectrum of all three cases.
 - c. Comment on the limitation of DTFT.
- B. Need for Short Time Fourier Transform(STFT):
 - a. How can you solve the above problem using STFT? Plot the STFT of one speech frame at the centre of above three regions. Write your observations.
- C. Concept of true and convolved spectra:
 - a. Create a sine wave of 200Hz and compute DTFT of the whole signal. Now also compute the STFT by taking a 20-30ms short term segment of the sine wave. Explain your observation and difference between the true and convolved spectrum.
- D. Effect of windowing function and window size on short term spectral analysis:
 - a. Plot short term log magnitude spectra of a 30 ms voiced speech segment using a rectangular, hamming and hanning window functions. Compare and write your observations in all the three cases.

- b. Plot a short term log magnitude spectra of the voiced segment using a frame size of 3 ms, 30 ms and 300 ms. Compare and write your observations in all the three cases.

SUBMISSION

- Submit a single pdf file, consisting of the following for each problem:
 - Theory
 - Procedure to carry out the experiment
 - Code (Matlab/Python)
 - Plots of the signal in the time domain and the magnitude spectrum.
 - Observations/Explanations wherever asked.

SUBMISSION FORMAT

- Submit a single pdf file, having the name as your roll number, Eg: **170010037.pdf** OR Submit a single zip with name as your roll number (**Eg: 170010037.zip**) containing the report and the codes. Note: Don't create a zip of the files directly. Submit the zip of a folder containing the files.

DEADLINE: 5:00 PM 14/03/2021