EE-414 Speech Processing Lab
Lab-8

AIM

- To understand motivation behind Cepstral Analysis of speech
- To understand basic Cepstral Analysis approach
- To perform vocal tract and source information separation by Cepstral Analysis
- To understand liftering concept in cepstral Analysis
- To develop a pitch determination method by Cepstral analysis.
- To develop a formant information determination method by Cepstral analysis.

PROBLEM STATEMENT

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

A. Fundamentals of cepstral analysis of speech:
    a. Select a frame (20 ms long) at the centre of a voiced segment. Plot the time waveform, the log-magnitude spectrum, and the cepstrum..
    b. Repeat the above for an unvoiced segment.
    c. Write the procedure to determine whether the segment is voiced/unvoiced by inspecting the cepstrum. Apply this procedure to the two segments (in a and b).
B. Liftering:
    a. Extract the deconvolved vocal tract component and excitation component from the cepstrum by liftering.
    b. Write about how you used Low-Time Liftering and High-Time Liftering for extracting the above components.
C. Pitch estimation by cepstral analysis:
    a. In the case of the voiced segment, estimate the pitch of the voiced speech segment using the cepstral analysis. Explain your procedure.
D. Formant estimation by cepstral analysis:
    a. Using liftered cepstrum, estimate the frequencies of the first three resonances of the vocal tract of the voiced speech frame.. Explain your procedure. Plot the log magnitude spectrum that shows the formant information (while not having the excitation information).
    b. Repeat the above for the unvoiced speech frame.

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 21/03/2021