EE-414 Speech Processing Lab
Lab-10

AIM

- Develop a method for the estimation of pitch by the autocorrelation of speech signal.
- Develop a cepstrum pitch estimation method.
- Develop a simple inverse filtering technique(SIFT) pitch estimation method.
- Comparison of all these three methods.

PROBLEM STATEMENT

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

A. Pitch estimation by autocorrelation method:
    a. Divide the given speech signal into 30-40ms blocks of speech frames. Find and plot the auto-correlation sequence of a voiced frame and an unvoiced frame.
    b. Estimate the pitch frequency using this computed auto-correlation for the above voiced frame and an unvoiced frame. You may set a threshold for a significant peak, and assign zero to pitch frequency if there is no significant peak.
B. Cepstrum based pitch estimation:
    a. Divide the speech into short segments of 15-20ms frame size. Compute the cepstrum of the speech segment in the quefrency domain for each of these frames and plot for one voiced frame.
    b. Estimate the pitch period by the high time liftering of the cepstrum of the voiced speech.
    c. Estimate the pitch period by the high time liftering of the cepstrum of the unvoiced speech.
C. Pitch estimation by Simple Inverse Filtering Technique (SIFT):
    a. Take a 30 ms voiced speech segment and compute the Linear Prediction (LP) residual by LP analysis. Perform autocorrelation on the LP residual. Estimate of pitch period from the autocorrelation sequence of the LP residual.
    b. Perform the same for the unvoiced speech segment also.
D. Comparison of pitch estimation methods:
    a. Plot the entire input speech signal and it's pitch contours estimated using autocorrelation, cepstrum and SIFT based pitch estimation methods.

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 04/03/2021