Speech Signal Processing
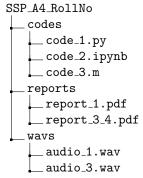## EC5.408

Assignment 4

Sep 26, 2023

Guidelines

- Do not copy or plagiarise. If you're caught for plagiarism, the penalty will range from **zero** in the assignment to **F** grade in the course.

- Cite your sources (be it images, papers or existing libraries) when necessary.

- Mention clearly if any assumptions are being considered.

- Only MATLAB or Python can be used for the coding part.

- Theory answers (in report) should be typed unless mentioned otherwise.

Submission Format

Make a directory using the naming format **SSP_A4_RollNo**. The submission might include codes **(.py/.m)** to answer the coding problems, reports **(.pdf)** to answer and plot the theory questions or notebooks **(.ipynb)** to answer both coding and theory questions together. Place the files in their respective folders and zip the main directory using the naming format **SSP_A4_RollNo.zip** and upload this zip file to Moodle.

This is how the final directory structure might look like

```
SSP_A4_RollNo
├── codes
│   ├── code_1.py
│   ├── code_2.ipynb
│   └── code_3.m
├── reports
│   ├── report_1.pdf
│   └── report_3_4.pdf
└── wavs
    ├── audio_1.wav
    └── audio_3.wav
```

Questions

[Maximum marks: 20]

1. Explain briefly about the following **[2]**

   (a) Zero Frequency Filtering (ZFF) [1]

   (b) Time-Scale Modification [1]

2. Using the given audio file, do the following, **[6]**

   (a) Compute the LP spectrum of the signal. [2]

   (b) Compute the LP spectrum of the LP residual of the signal. [2]

   (c) What are your observations? Comment on which method is better for estimating **Pitch**. [2]

3. Using the same audio file as **Q2**, compute **epochs** using the ZFF approach **[4]**

4. Calculate the 7 prosody features for 4 wave files of the same sentence spoken by different **native** speakers (mother tongue). Comment on variations in each feature for different speakers. **[4 * 2]**

   Use this sentence: **"Baahar baarish ho rahi hai"**. The same sentence should be recorded as spoken by 4 different **native** speakers. For example, the speakers could be Telugu, Hindi, Tamil and Marathi but they should be speaking the same Hindi sentence given.

   NOTE: The report can be one (or separate, your preference) **PDF** with all the theory answers and plots or you can also choose to do the entire assignment in one python notebook **(.ipynb)** by answering theory in markdown and code directly in it.