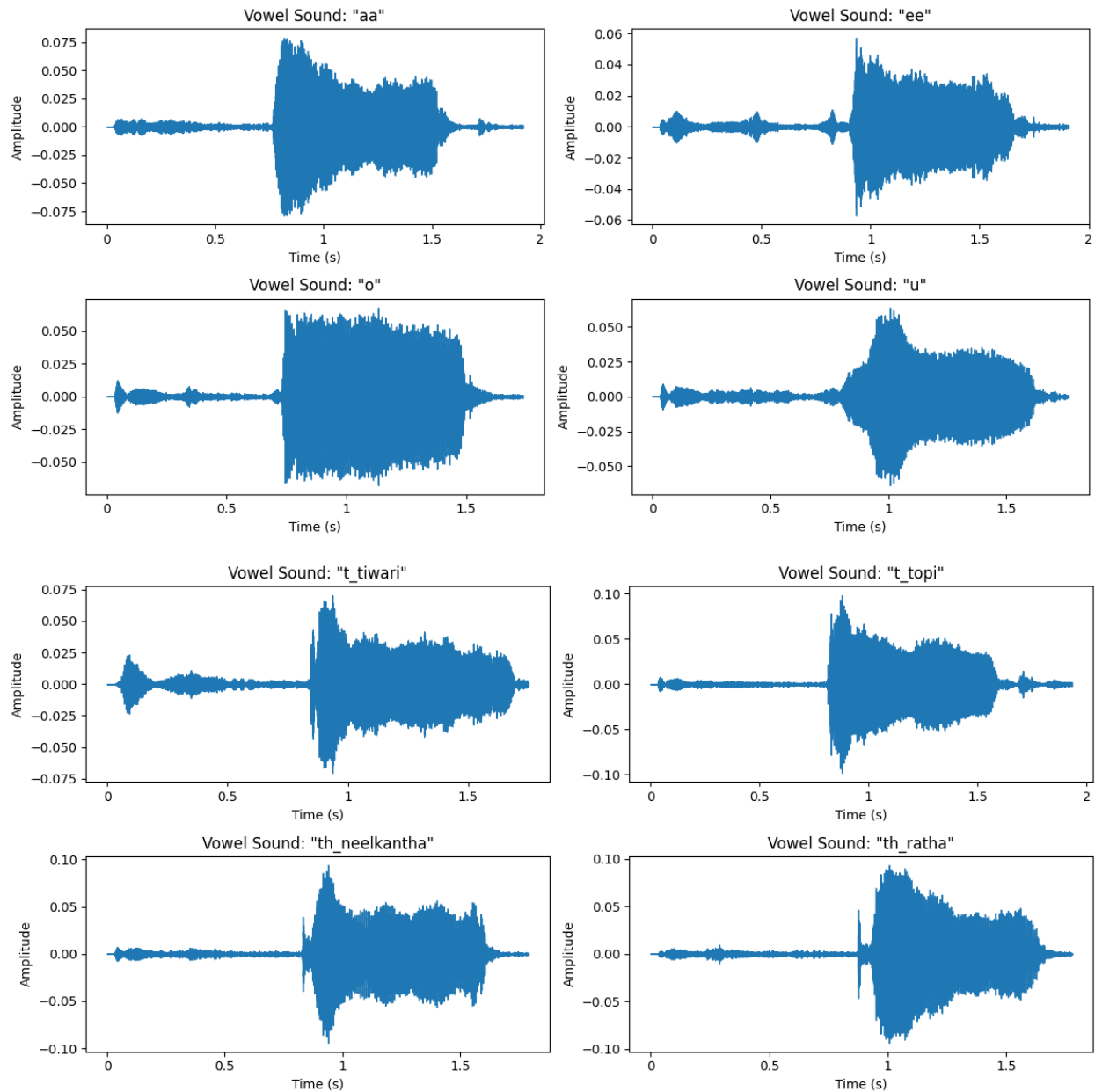


## Assignment 2

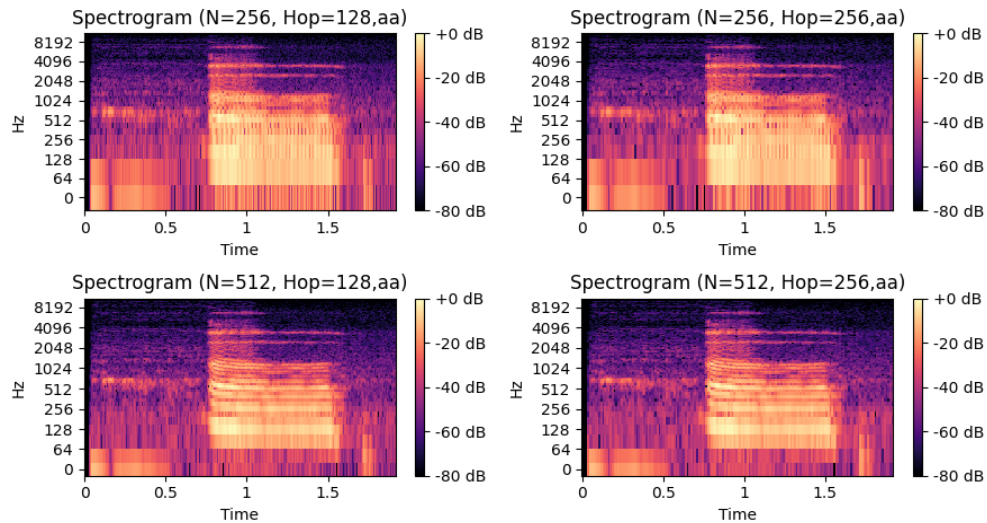
### Waverforms (aa,ee,o,u,t\_tiwari,t\_topi,th\_neelkantha,th\_ratha) :



### Spectrograms (aa,ee,o,u) :

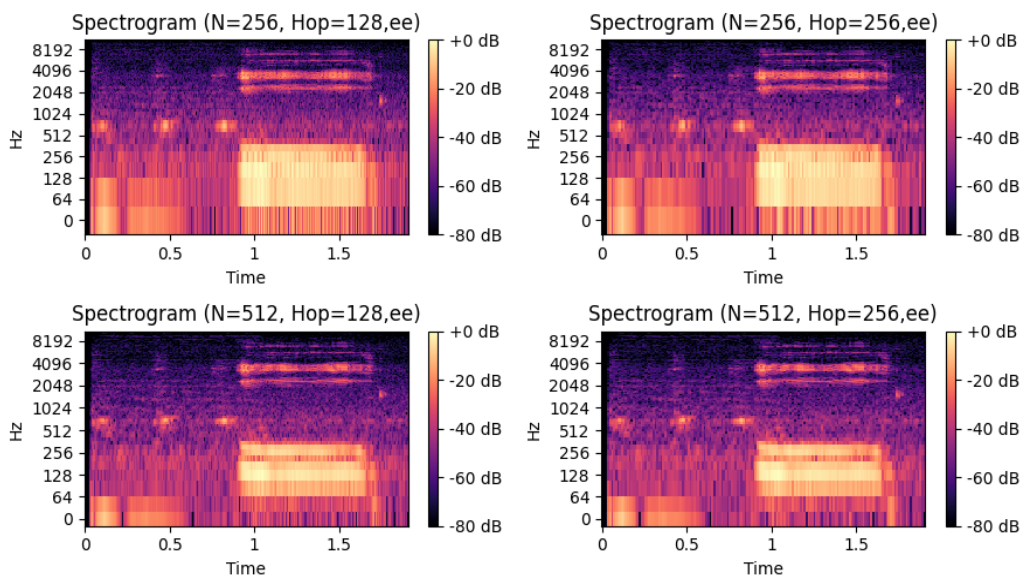
'aa' Vowel Sound:

- Frequency Range: The 'aa' sound typically exhibits a lower frequency range, with formants concentrated in the lower frequencies.
- Intensity: The spectrogram shows consistent intensity, with well-defined formants.
- Formants: Formants are visible around 700 Hz, 1100 Hz, and 2600 Hz.
- Duration: The 'aa' sound has a relatively long duration, indicating a steady-state portion.



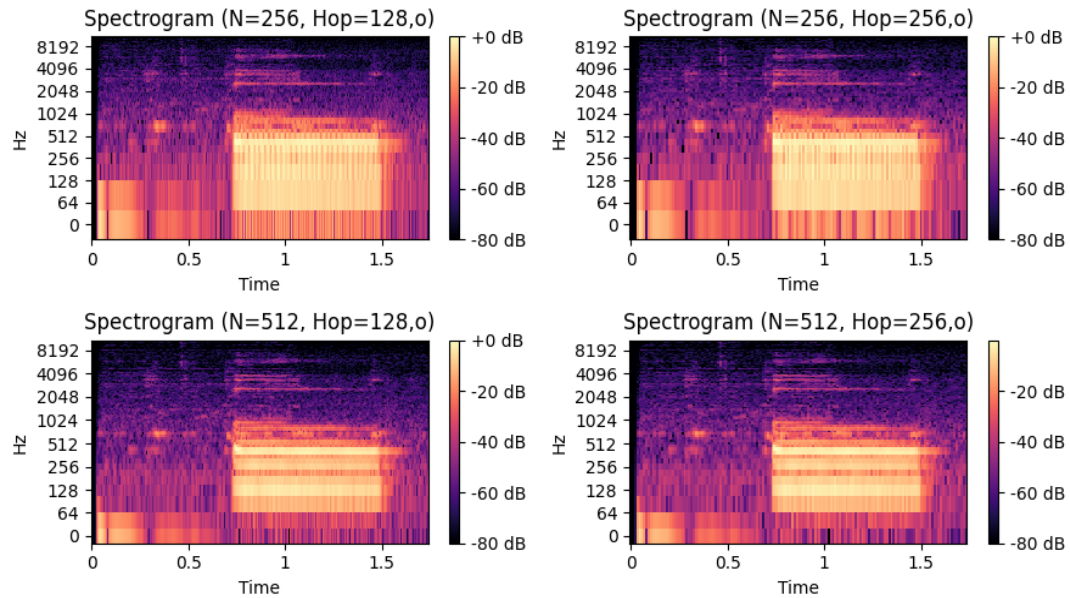
### 'ee' Vowel Sound:

- Frequency Range: The 'ee' sound spans a higher frequency range compared to 'aa,' with formants in the higher frequencies.
- Intensity: The spectrogram displays higher intensity in the higher frequency regions.
- Formants: Formants are prominent around 300 Hz, 1700 Hz, and 2800 Hz.
- Duration: The 'ee' sound is relatively shorter in duration.



### 'o' Vowel Sound:

- Frequency Range: The 'o' sound has a moderate frequency range, with formants distributed evenly.
- Intensity: The spectrogram shows balanced intensity across the spectrum.
- Formants: Formants are observed around 450 Hz, 800 Hz, and 2800 Hz.
- Duration: The 'o' sound has a moderate duration.

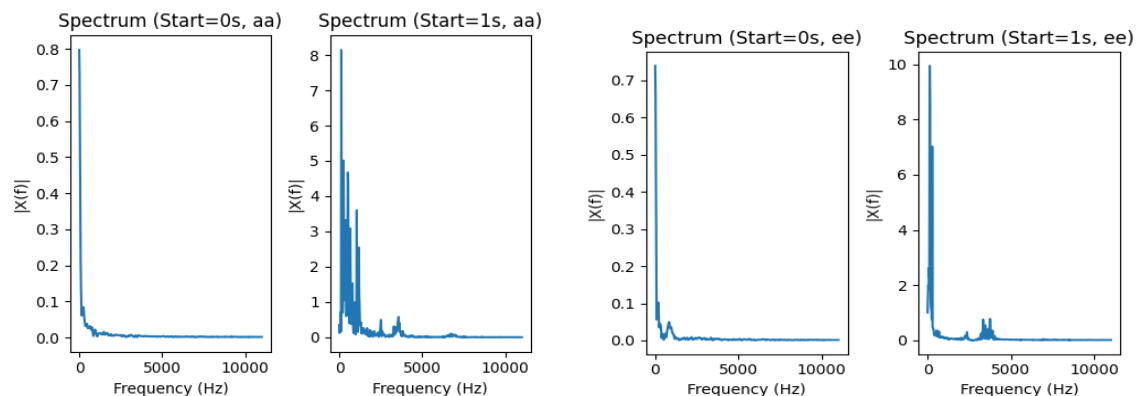


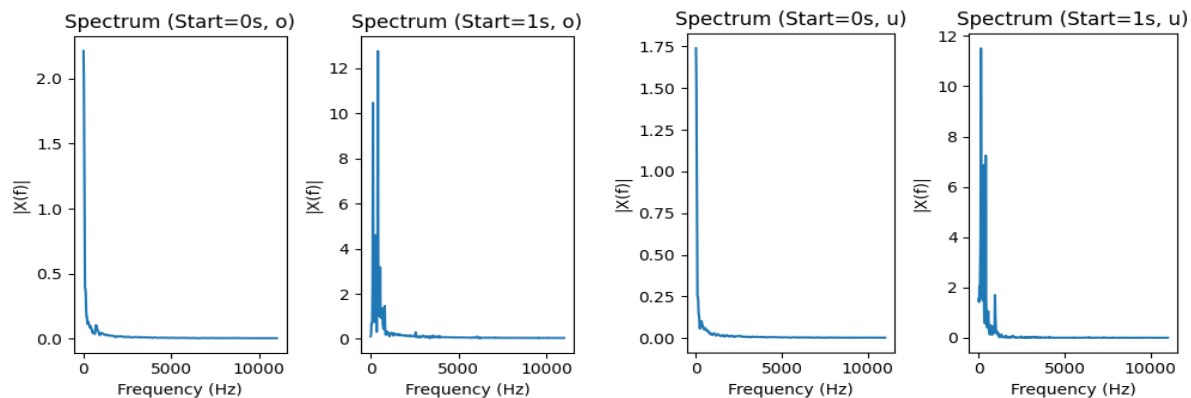
### 'u' Vowel Sound:

- Frequency Range: The 'u' sound exhibits a higher frequency range, with concentrated formants in the upper frequencies.
- Intensity: The spectrogram indicates higher intensity in the higher frequency bands.
- Formants: Formants are clearly visible around 325 Hz, 700 Hz, and 2530 Hz.
- Duration: The 'u' sound has a moderate duration, with a steady-state portion.

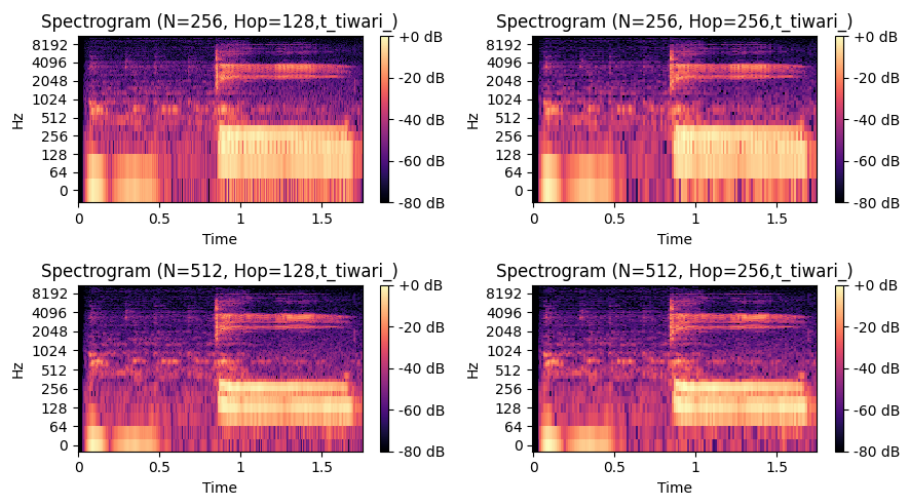
### Spectra (aa,ee,o,u) :

- Spectra of the vowel sounds reveal additional insights into their frequency content.
- 'aa' shows strong harmonics around 700 Hz, corresponding to the first formant.
- 'ee' exhibits pronounced harmonics around 300 Hz, representing the first formant.
- 'o' displays harmonics around 450 Hz, corresponding to the first formant.
- 'u' reveals strong harmonics around 325 Hz, associated with the first formant.



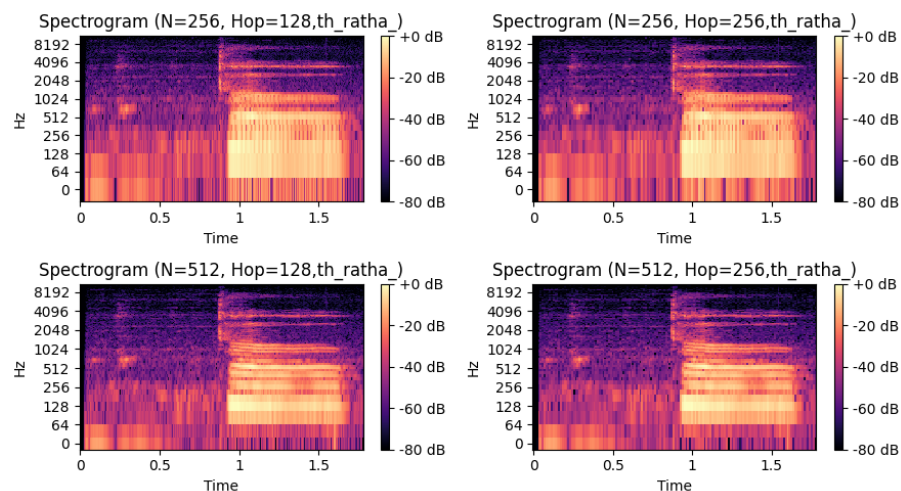


### Spectrograms (t\_tiwari,t\_topi,th\_neelkantha,th\_ratha) :



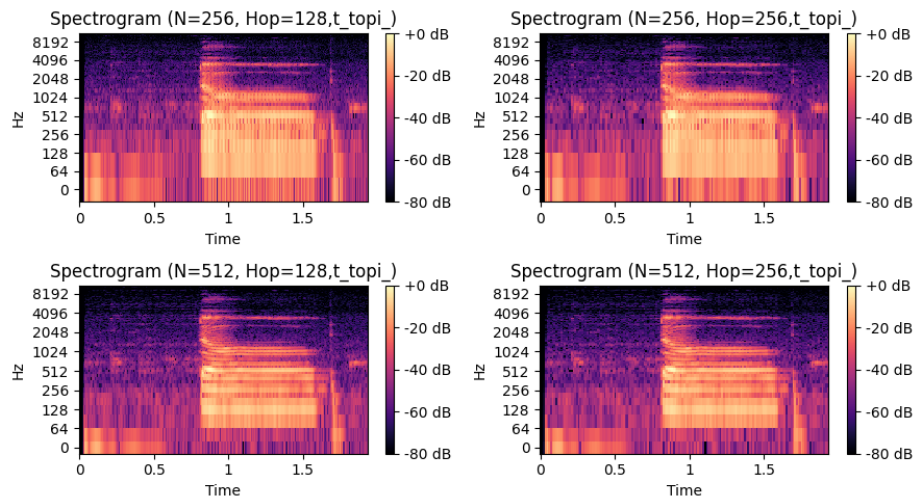
### 't' Consonant Sound (as in "tiwari"):

- Frequency Range: The 't' sound exhibits a spectrum with a sharp onset and rapid decay.
- Intensity: The spectrogram shows an intense burst of energy at the beginning.
- Duration: The 't' sound is relatively short in duration, with a sudden onset and release.



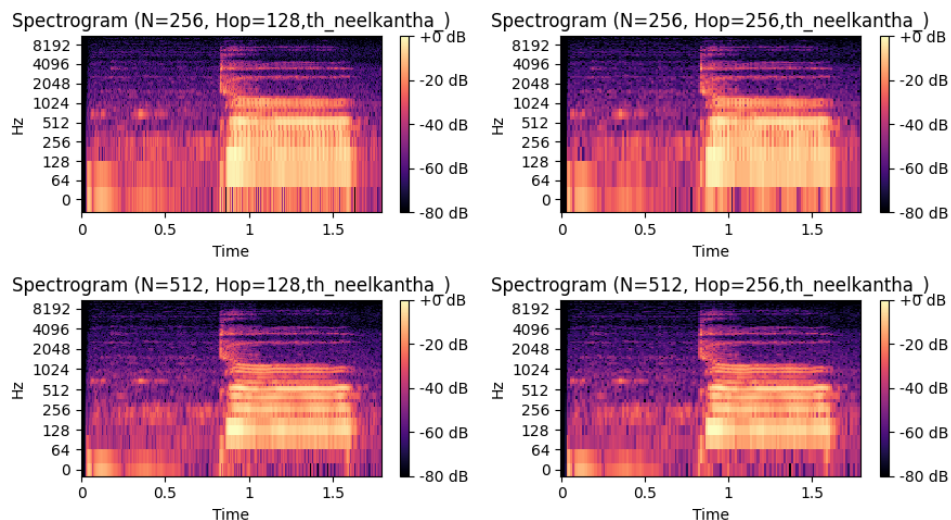
### 'th' Consonant Sound (as in "ratha"):

- Frequency Range: The 'th' sound demonstrates a spectrum similar to 't' but may have a longer duration.
- Intensity: The spectrogram indicates an intense burst of energy, similar to 't.'
- Duration: The 'th' sound may have a longer duration compared to 't.'



### 't' Consonant Sound (as in "topi"):

- Frequency Range: Similar to the 't' sound in "tiwari," it exhibits a sharp onset and rapid decay.
- Intensity: The spectrogram shows an intense burst of energy at the beginning.
- Duration: The 't' sound is relatively short in duration, similar to "tiwari."

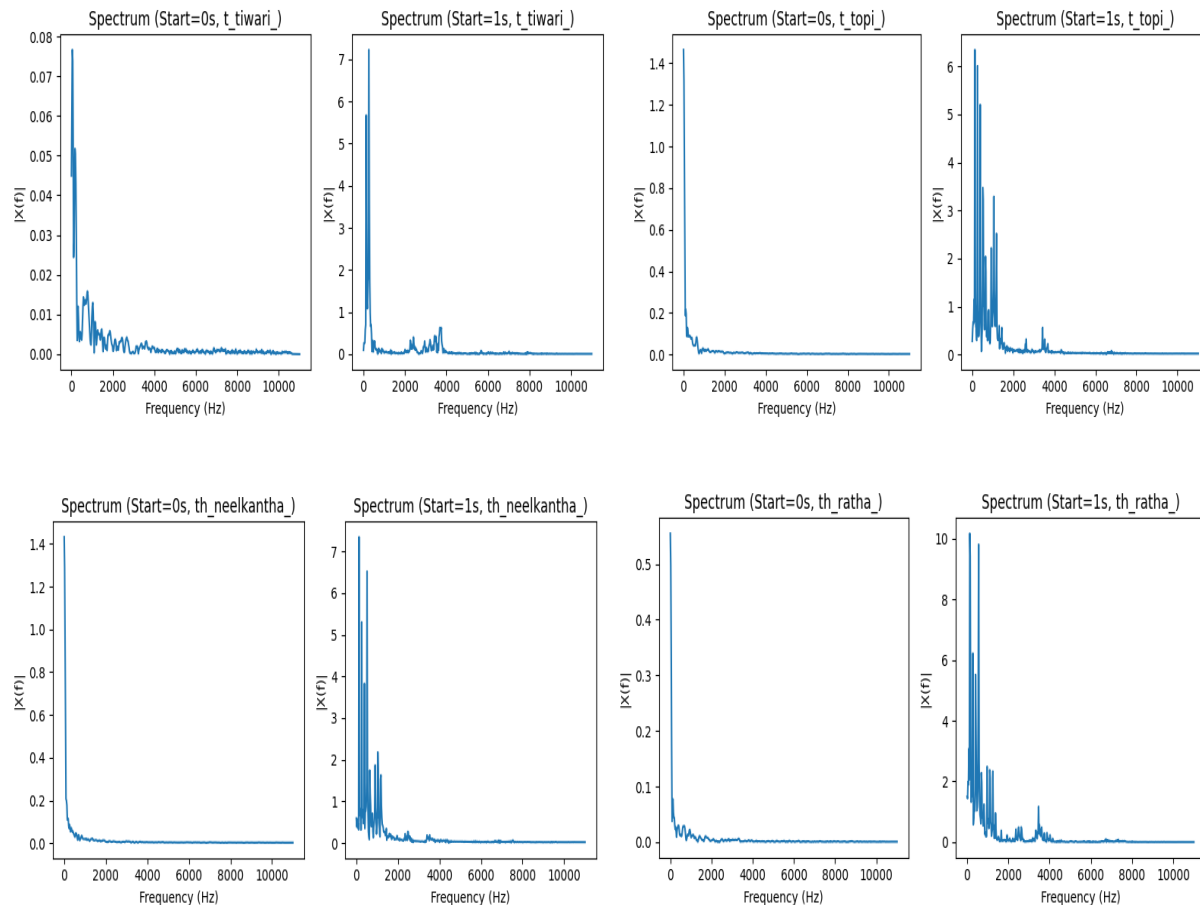


### 'th' Consonant Sound (as in "neelkantha"):

- Frequency Range: The 'th' sound in "neelkantha" may have a spectrum similar to 'th' in "ratha."
- Intensity: An intense burst of energy is observed at the beginning, resembling 'th' in "ratha."
- Duration: The 'th' sound may have a longer duration, similar to "ratha."

### Spectra (t\_tiwari,t\_topi,th\_neelkantha,th\_ratha) :

- The spectra of these consonant sounds reveal sharp onsets with prominent energy bursts.
- 't' and 'th' sounds exhibit intense harmonic patterns in the higher frequency range.
- The duration of these sounds may vary, with 'th' sounds potentially having a longer duration.



### Effects of dB Scale:

- When using the dB scale for spectra, it represents the amplitude of each frequency component in a logarithmic scale, compressing the dynamic range.
- In spectrograms, the dB scale converts color intensity to a logarithmic scale, making soft sounds and background noise more visible.

### Effects of Mel-Scale:

- The mel-scale is perceptually-based and warps the frequency axis, emphasizing lower frequencies where human hearing is most sensitive.
- In spectra, the mel-scale enhances resolution at lower frequencies and reduces it at higher frequencies.
- In spectrograms, the mel-scale aligns the frequency axis with human perception, making it suitable for speech-related tasks.



