CM3065 Intelligent Signal Processing Midterm

Coursework Exercise2:

Task 1:

Audio	Meyda audio features	Justification
Sound 1 - Ex2_sound1.wav	Amplitude Spectrum	It calculates the amplitude of each index in this complicated array. The distribution of frequencies in the signal and their matching strengths are the outcome.
Sound 1 - Ex2_sound1.wav	Zero Crossing Rate (ZCR)	ZCR is the term used to describe the frequency at which a signal crosses the buffer's zero value. As a result, percussion and pitched sounds may be distinguished. I think this sound clip begins with a percussive sound and ends with a pitched sound. Pitched sounds have a more consistent value, but percussion sounds change in ZCR across buffers, in general.
Sound 1 - Ex2_sound1.wav	Spectral Centroid	It serves as the brightness indicator. The spectral centroid should be in the appropriate area of the x line since this sound is very bright and has greater energy.
Sound 2 - Ex2_sound2.wav	Zero Crossing Rate (ZCR)	ZCR is the term used to describe the frequency at which a signal crosses the buffer's zero value. As a result, percussion and pitched sounds may be

		distinguished. I think this sound clip begins with a percussive sound and ends with a pitched sound. Pitched sounds have a more consistent value, but percussion sounds change in ZCR across buffers, in general.
Sound 2 - Ex2_sound2.wav	Spectral Flatness	The degree of a spectrum's flatness can be measured. Based on the separation of geometric and mathematical means, the calculation is made. It establishes the volume of a sound as well as its quality. Due to the value's proximity to zero, it is not initially flat. Pure sine waves are closer to 0.0 in flatness, while white noise has a flatness of about 1.0. As the sound gets louder and louder over time, white noise, which first seems to be fairly flat, starts to become not flat.
Sound 2 - Ex2_sound2.wav	Amplitude Spectrum	The amplitude spectrum describes the relationship between component frequency and the amplitude of signal components. The distribution of frequencies in the signal and their matching strengths are the outcome.
Sound 3 - Ex2_sound3.wav	Spectral Flatness	A spectral flatness measurement measures how flat a spectrum is. The calculation is based on the division of mathematical and geometric means. In

		addition to determining loudness, it also determines the quality of a sound. It's not flat at the beginning because the value is close to zero. In contrast, white noise has a flatness of approximately 1.0, while pure sine waves are closer to 0.0. I think the overall sound is not flat.
Sound 3 - Ex2_sound3.wav	Zero Crossing Rate (ZCR)	The frequency of the signal crossing the zero value of the buffer is called ZCR. This helps to distinguish between pitched and percussion sounds. Pitched sounds have a more constant value, while percussion sounds vary in ZCR between buffers, in common, I believe this sound clip starts with a percussive sound and finishes with a pitched sound.
Sound 3 - Ex2_sound3.wav	Spectral Centroid	How bright a sound is depends on its spectral centroid. Due to the relatively small range of values, the Spectral Centroid is low.

Task 2:

In task 2 I have created a audio visualisation web application as asked. The audio which was given in the Coursera template file was used for this web application. And the meyda audio features were implemented in this. They are:

1) Root Mean Square(RMS): utilize it to determine the average audio signal strength and to manage the overall brightness of our graphic depiction.
2) Zero Crossing Rate(ZCR): ZCR determines how quickly an audio signal may go from positive to negative or the other way around. We employ it to create visual effects, like rotating our rectangular box.
3) Spectral Centroid: a symbol that denotes the "brightness" of a sound and the spectral center of gravity.
4) Amplitude Spectrum: By using the Fast Fourier Transform, we may obtain a frequency domain representation of the signal (FFT). In this complex array, the amplitude spectrum is used to determine the amplitude of each index.

5) Spectral Spread: the spectrum's distribution of the frequency content is demonstrated. matching the frequency's bandwidth.

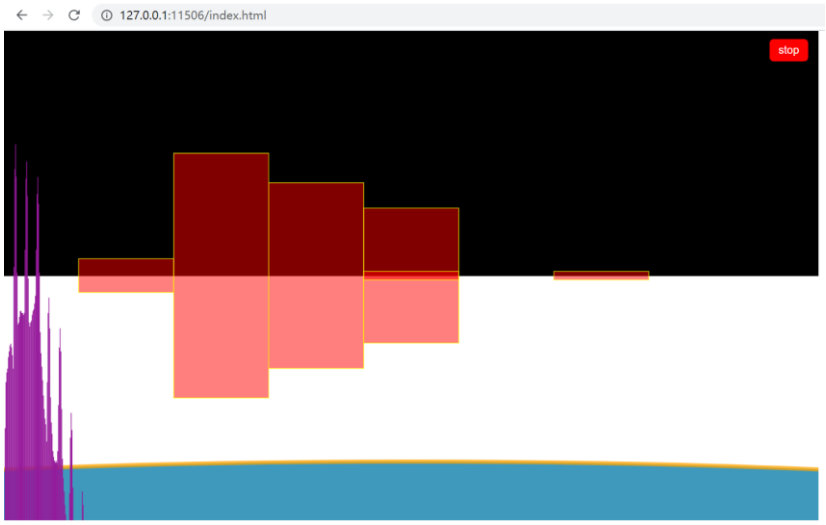
6) Spectral Crest: utilized it to regulate the overall brightness and to measure the audio signal's peak amplitude spectrum.
7) Loudness: Filters that more accurately reflect how individuals perceive loudness may be created using this technique.

All the codes for the Meyda audio features are shown in the figure below:

```
function handleMeydaCallback(features) {
    // rms
    var rms = features.rms
    if (rms) {
        rmsReported = rms
        if (!rmsMax || rmsMax < rms) rmsMax = rms
    }

    // spectralCentroid
    var spectralCentroid = features.spectralCentroid
    if (spectralCentroid) {
        spectralCentroidReported = spectralCentroid
        if (!spectralCentroidMax || spectralCentroidMax < spectralCentroid) spectralCentroidMax = spectralCentroid
    }

    // amplitudeSpectrum
    var amplitudeSpectrum = features.amplitudeSpectrum
    if (amplitudeSpectrum && !amplitudeSpecReport) {
        amplitudeSpecReport = amplitudeSpectrum
    }

    // spectralSpread
    var spectralSpread = features.spectralSpread
    if (spectralSpread) {
        const spectralSpreadBox = parseInt(spectralSpread / 10)
        const spectralSpreadBoxBounded = max(0, min(spectralSpreadBoxes - 1, spectralSpreadBox))
        histogram[spectralSpreadBoxBounded]++
    }

    // spectralCrest
    var spectralCrest = features.spectralCrest
    if (spectralCrest) {
        spectralCrestReported = spectralCrest
        if (!spectralCrestMax || spectralCrestMax < spectralCrest) spectralCrestMax = spectralCrest
    }

    // loudness
    var loudness = features.loudness
    if (loudness && loudness) {
        loudnessReported = loudness.total
        if (!loudnessMax || loudnessMax < loudness.total) loudnessMax = loudness.total
    }
}
```

Output of the application before playing and after playing:

(Before)



(After)

Sharable Link:_

When you run this link the application wont work because of the special characters occurring in the link after false, so you can refer to the below link:

https://hub.labs.coursera.org:443/connect/sharedbevkyhxc?forceRefresh=false&path=%2FvMBxTlyvUcM5DXb37Upsye6EhaJPW4z7oTLHiHdIrBJcLsAIkbpg8LFmKA6qdMB0%2F

Working Link:

https://www.coursera.org/learn/uol-cm3065-intelligent-signal-processing/ungradedLab/mtKae/link-generator-exercise-2/lab?path=%2FvMBxTlyvUcM5DXb37Upsye6EhaJPW4z7oTLHiHdIrBJcLsAIkbpg8LFmKA6qdMB0%2F