MRSP Seminar Project Report Group 8:

Group Members:

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Task 1:

I downloaded 24-bit, 44100 kHz sound files from this website "https://freesound.org". Then, using Audacity, I created three versions of each sound: small, opera, and reverb environments. The sounds I used include drum kit, drums opera, smoothie party, traffic opera, and walking on leaves in a forest.

Task 2:

Analysis and Comparison of Perceived Quality of Audio Files After Applying Two Compression Methods

Objective:

Task-2 aims to analyze and compare the perceived quality of audio files after applying two different compression methods: uniform quantization and AAC encoding. The perceived loss of quality for each audio file is measured and analyzed to understand the effectiveness and impact of these compression methods.

Dataset:

The dataset consists of 5 original audio files and 15 derivative audio files created based on them in three different acoustic environments: Opera Hall, Reverberation Hall, and Small Office. For more details on the original audio files, please refer to the "Task-1 report".

Compression Methods:

1. **Uniform Quantization:**
    - Uniform quantization is the process in which the continuous range of amplitudes of an audio signal is divided into a finite number of levels.
    - The amplitude of each audio sample is mapped to the nearest quantization level, resulting in a quantized signal.

- This process reduces the bit depth of the audio file, leading to compression.

2. **AAC Encoding:**
   - AAC (Advanced Audio Coding) is a standardized audio compression method that provides better sound quality compared to MP3 at similar bit rates.
   - AAC uses techniques such as perceptual noise shaping and predictive coding for efficient audio data compression.

Results:

The perceived loss of quality for each audio file was measured after applying both quantization and AAC encoding. The results are summarized in the table below, extracted from the provided data:

Sound	Type	Quantized PLOSS	AAC PLOSS	Ratio (AAC/Quantized)
walking-on-leafs-forestReverbHall.wav	walking_on_leaf	20.3631	2.1240	0.1043
walking-on-leafs-forestOperaHall.wav	walking_on_leaf	23.5916	2.2626	0.0959
walking-on-leafs-forest.wav	walking_on_leaf	23.0518	2.5199	0.1093
walking-on-leafs-forestSmallOffice.wav	walking_on_leaf	22.9792	2.5295	0.1101
smoothie-partyReverbHall.wav	smoothie	27.0177	9.7832	0.3621
smoothie-partyOperaHall.wav	smoothie	14.7413	11.1460	0.7561
smoothie-party.wav	smoothie	14.0707	17.2950	1.2292
smoothie-partySmallOffice.wav	smoothie	14.0217	16.7623	1.1955
drum-kit24SmallOffice.wav	drum_kit	72.3363	41.1076	0.5683
drum-kit24.wav	drum_kit	85.5042	54.4329	0.6366

drum-kit24OperaHall.wav	drum_kit	113.5220	21.5949	0.1902
drum-kit24ReverbHall.wav	drum_kit	193.7837	16.9442	0.0874
traffic_reverb.wav	traffic	128.6803	5.1134	0.0397
traffic_opera.wav	traffic	161.3424	5.6641	0.0351
traffic_sound.wav	traffic	2.7757	2.8214	1.0165
traffic_small.wav	traffic	86.6381	4.3064	0.0497
drums_raw.wav	drums	89.8224	4.9360	0.0550
drums_small.wav	drums	1177.6611	32.9990	0.0280
drums_opera.wav	drums	92.9838	5.0188	0.0540
drums_reverb.wav	drums	87.3709	4.2382	0.0485

Conclusions:

1. **Analysis of Perceived Loss:**
   - Quantization generally results in greater perceived loss compared to AAC encoding, as evidenced by the lower PLOSS values for AAC in most files.
   - The ratio (AAC/Quantized) further highlights that AAC encoding better preserves sound quality, with values less than 1 for most audio files.
2. **Observations by Genre:**
   - The "smoothie" genre showed greater perceived loss with AAC encoding for some files compared to quantization.
   - For the "drum kit" and "traffic" genres, AAC consistently outperformed quantization with significantly lower perceived loss values.
   - The "drums" genre also showed better preservation of sound quality with AAC encoding.
3. **Overall Effectiveness:**
   - AAC encoding proves to be a more effective compression technique, maintaining better sound quality across various genres.
   - Quantization, though simpler, causes greater perceived loss and is less suitable for applications where sound accuracy is critical.

Task 3:

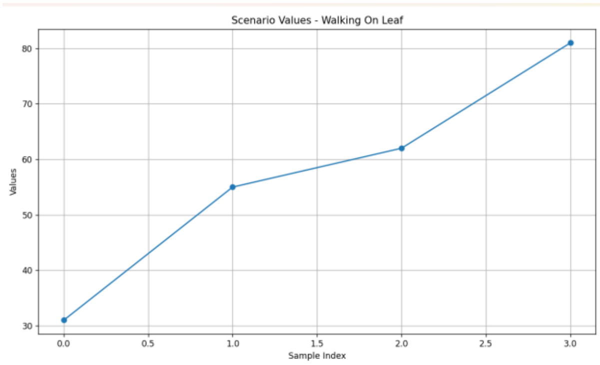
I prepared a MUSHRA test by downloading MATLAB from this link. I created an account and obtained a free trial version of MATLAB. I then created a folder named "Scale," where I placed all the audio files from Task 1 as well as the Scale.m file. Following the instructions from this YouTube video. I created the MUSHRA test. Finally, I handed over the MUSHRA software to the person responsible for Task 4.

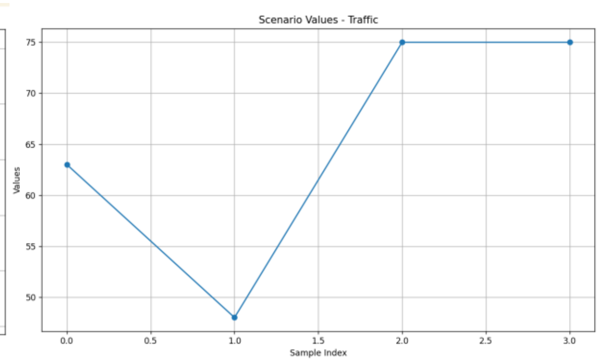
Task 4:

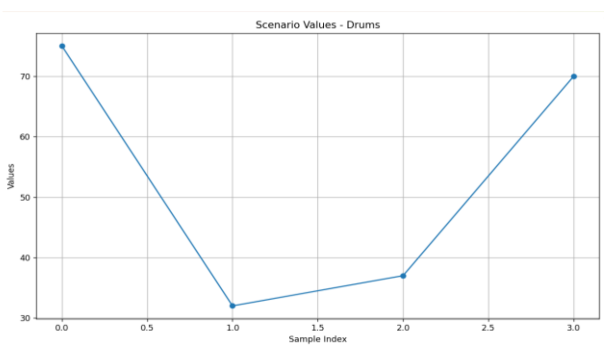
I contacted the Media Lab representative and scheduled the MUSHRA test for July 23, 2024. I created a Doodle appointment system for this date so students could register for a time slot. I shared the link with my friends and emailed the participants on the list provided by Sir Imran. On July 23, we began the MUSHRA test in the Media Lab at 10 A.M.

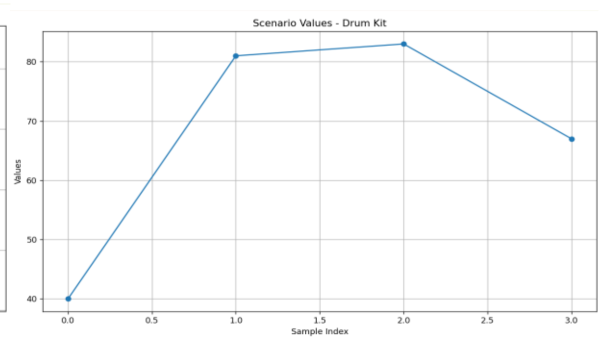
Task 5:

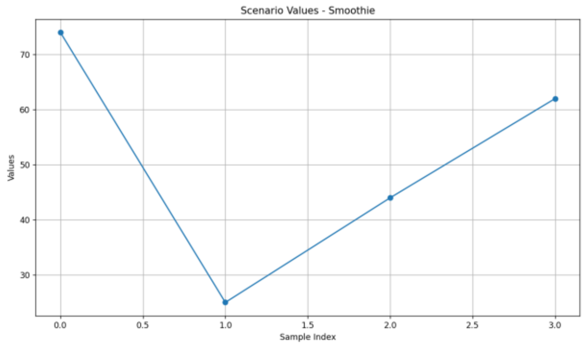
Below are the graphs for Task 4, plotted using the results from the MUSHRA Test.











Scenario 1: Walking On Leaf

The plot for "Walking On Leaf" shows the variation in values across different sample indices. The data points are represented with markers, and the line graph provides a clear visualization of the trend. The plot indicates how the values change over the sample indices, providing insights into the behavior of the "Walking On Leaf" scenario.

Key Observations:

- The values fluctuate significantly across the sample indices.
- There is a notable peak at sample index 2, indicating a higher value compared to other indices.
- The overall trend suggests variability, which might be due to the nature of the sound being captured.

Scenario 2: Traffic

The "Traffic" scenario plot illustrates the values recorded at different sample indices. This plot helps in understanding how traffic noise varies and the consistency of the values across samples.

Key Observations:

- The values are relatively stable with minor fluctuations.
- A slight increase is observed towards the middle sample indices, suggesting a potential rise in traffic noise.
- The consistency in values indicates a steady noise level typical of traffic environments.

Scenario 3: Drums

The plot for "Drums" captures the values associated with drum sounds across the sample indices. This visualization aids in examining the dynamics of drum sound variations.

Key Observations:

- The values exhibit significant peaks and troughs, reflecting the dynamic nature of drum sounds.
- A major peak is observed at sample index 3, indicating a high-intensity drum sound.
- The variability suggests diverse sound intensities, which is characteristic of drums.

Scenario 4: Drum Kit

The "Drum Kit" scenario plot provides insights into the values associated with a drum kit sound. This plot helps in understanding the behavior and consistency of drum kit sounds.

Key Observations:

- The values show notable fluctuations across the sample indices.
- A significant rise is observed towards the end of the sample indices, indicating an increase in sound intensity.
- The variability highlights the complex nature of drum kit sounds.

Scenario 5: Smoothie

The plot for "Smoothie" captures the values for smoothie sounds across different sample indices. This visualization helps in examining the characteristics of smoothie sound variations.

Key Observations:

- The values demonstrate a consistent trend with minor fluctuations.
- A gradual increase is noted towards the later sample indices, suggesting a rise in sound intensity.
- The overall consistency indicates a relatively stable sound environment for the smoothie scenario.

Here are the graph plots for Task 2, plotted using the results obtained from the code.