Audio Data Collection Lab

Lab Overview

The purpose of this lab is to provide a comprehensive understanding of the process involved in audio data collection. You will undertake tasks such as labelling, feature extraction, and data cleaning while also developing a protocol for acquiring audio data. Additionally, this lab will introduce you to the ethical considerations associated with audio data collection. Upon completion, you should be proficient in handling audio data, formulating protocols for data collection, and setting up equipment for high-quality data acquisition.

Learning Objectives

By the end of this lab, you should be able to:

1. Perform audio data collection and labelling.
2. Understand the process of feature extraction and data cleaning.
3. Develop a comprehensive protocol for audio data collection that considers both technical setup and ethical considerations.

Dataset

UrbanSound8K

The dataset used for this lab is the UrbanSound8K dataset, which contains 8,732 labeled sound excerpts (each lasting less than 4 seconds) from urban environments. The dataset is divided into 10 classes:

1. Air_conditioner
2. Car_horn
3. Children_playing
4. Dog_bark
5. Drilling
6. Engine_idling
7. Gun_shot
8. Jackhammer
9. Siren
10. Street_music

The dataset is organised into 10 folders (fold1-fold10) to aid in reproducibility and comparison of classification results.

Dataset Link: UrbanSound8K Dataset

Note: You can code using Google Colab or Jupyter Notebook

Tasks

Task 1: Audio Data Collection and Quality Assessment

1. Download 20 audio files for each of the four classes from the UrbanSound8K dataset.
2. Identify and discuss potential audio quality issues that might necessitate the exclusion of certain files (e.g., noise interference, low volume, or distortion).

3. Describe preferred uniform settings (such as sampling rate, bit depth, or format) that should be maintained across all audio files for consistency.

Task 2: Data Labelling and Frequency Plot Analysis

1. Assign labels to each audio file corresponding to the class they represent.
2. For one audio file from each class, generate a spectrogram. Alongside each plot, include the code used for generating the analysis.

Task 3: Feature Extraction and Data Cleaning

1. Extract relevant statistical and frequency-domain features from each audio file (e.g., mean frequency, standard deviation, spectral centroid).
2. Store these features in a CSV file, where each row corresponds to the features of one audio file. Ensure one column represents the class name.
3. Identify and remove any empty or irrelevant columns during data cleaning.
4. Explain the process you followed for feature extraction and data cleaning.
5. Submit the CSV file containing the features. The final CSV should contain 80 rows (20 audio files x 4 classes).

Task 4: Protocol Development for Audio Data Collection

Consider a scenario where audio data is collected via direct recording rather than downloading from a dataset. Develop a detailed protocol for the following aspects: (1 or 1.5 page is enough)

1. **Challenges in Data Collection**: Discuss challenges such as background noise, environmental variability, equipment limitations, and storage constraints.
2. **Data Collection Protocol**:
    - Outline the equipment and setup required to ensure high-quality recordings.
    - Specify environmental conditions, microphone types, and recording formats.
3. **Ethical Considerations**: Develop guidelines that ensure ethical compliance during data collection, addressing aspects such as consent, privacy, storage and data security.