

Speech Emotion Recognition - Week 1

Resources Only

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Week 1: Signal Processing Fundamentals - Resources

Setup

1. Install Python 3.8+
2. Create virtual environment: `python3 -m venv ser_env`
3. Activate: `source ser_env/bin/activate`
4. Install: `pip install librosa scipy numpy matplotlib jupyter`

Reading Materials

- **Sampling Theorem:** Khan Academy - Sampling and Aliasing
- **FFT Explained:** 3Blue1Brown - "But what is the Fourier Transform?" Youtube
- **MFCC Theory:** GeeksforGeeks - MFCC for Speech Recognition Geeks for Geeks

Video Tutorials

- MFCC Calculation: Youtube
- Audio Processing Basics: Valerio Velardo Playlist Youtube
- Extract Features from Audio: Youtube

Dataset

- **RAVDESS Audio:** Kaggle
- Size: 7.5 GB, 7,356 samples, 8 emotions
- Download and extract to: `data/raw/RAVDESS/`

Python Code Templates

Load Audio

```
import librosa

y, sr = librosa.load('audio.wav', sr=22050)
print(f"Duration: {len(y)/sr:.2f}s")
```

Extract MFCC

```
mfcc = librosa.feature.mfcc(y=y, sr=sr, n_mfcc=13)
delta = librosa.feature.delta(mfcc)
delta_delta = librosa.feature.delta(delta)
print(f"MFCC shape: {mfcc.shape}")
```

Generate Spectrogram

```
import matplotlib.pyplot as plt
import numpy as np

S = librosa.feature.melspectrogram(y=y, sr=sr)
S_db = librosa.power_to_db(S, ref=np.max)

plt.figure(figsize=(10, 4))
librosa.display.specshow(S_db, sr=sr, x_axis='time', y_axis='mel')
plt.colorbar(format='%+2.0f dB')
plt.show()
```

Assignments

1. Load 5 audio files, print their properties (sample rate, duration, max amplitude)
2. Extract MFCC from 3 different emotions, plot side-by-side
3. Generate spectrograms for happy vs. sad, compare frequency patterns

Expected Outputs

- Python environment working
- RAVDESS dataset downloaded
- 3 Jupyter notebooks/scripts with assignments completed
- 3 visualization plots saved
- Written observations (1 page)

Quick Links

- Librosa Docs: <https://librosa.org/>
- SciPy Signal: <https://docs.scipy.org/doc/scipy/reference/signal.html>
- Matplotlib Tutorials: <https://matplotlib.org/stable/tutorials/>