# ltnl0lqz0

March 12, 2025

[1]:
```
import warnings
warnings.filterwarnings('ignore')
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import librosa.display
import os
from sklearn.model_selection import train_test_split
```

[2]:
```
path = 'C:/Users/jai matha di pc/Downloads/
 ↪Speech_Emotion_Recognition_Model-master/
 ↪Speech_Emotion_Recognition_Model-master/data/AudioWAV/'
audio_path = []
audio_emotion = []
```

[3]:
```
directory_path = os.listdir(path)
```

[4]:
```
for audio in directory_path:
    audio_path.append(path + audio)
    emotion = audio.split('_')
    if emotion[2] == 'SAD':
        audio_emotion.append("sad")
    elif emotion[2] == 'ANG':
        audio_emotion.append("angry")
    elif emotion[2] == 'DIS':
        audio_emotion.append("disgust")
    elif emotion[2] == 'NEU':
        audio_emotion.append("neutral")
    elif emotion[2] == 'HAP':
        audio_emotion.append("happy")
    elif emotion[2] == 'FEA':
        audio_emotion.append("fear")
    else:
        audio_emotion.append("unknown")
```

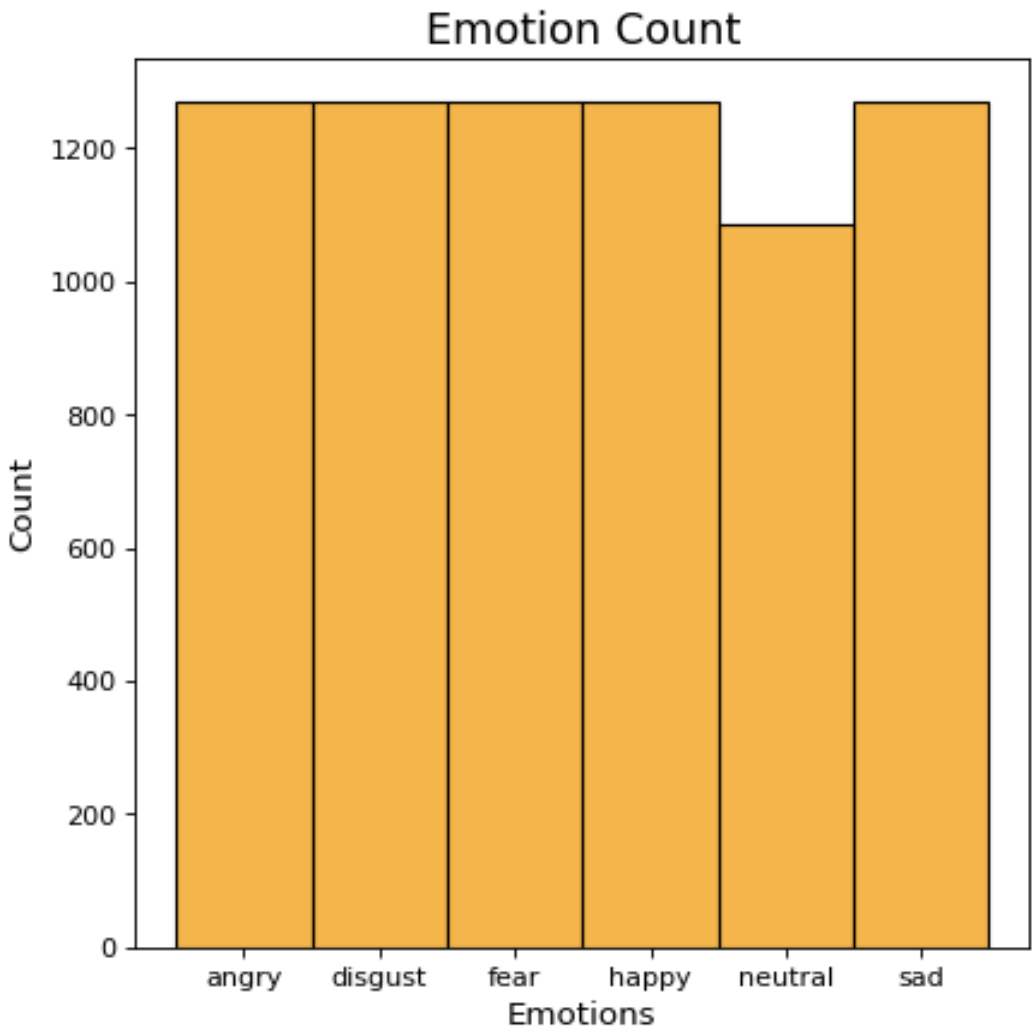
[5]:
```
emotion_dataset = pd.DataFrame(audio_emotion, columns=['Emotions'])
audio_path_dataset = pd.DataFrame(audio_path, columns=['Path'])
dataset = pd.concat([audio_path_dataset, emotion_dataset], axis= 1)
print(dataset.head())
```

```
                                                Path Emotions
0  C:/Users/jai matha di pc/Downloads/Speech_Emot…    angry
1  C:/Users/jai matha di pc/Downloads/Speech_Emot…  disgust
2  C:/Users/jai matha di pc/Downloads/Speech_Emot…     fear
3  C:/Users/jai matha di pc/Downloads/Speech_Emot…    happy
4  C:/Users/jai matha di pc/Downloads/Speech_Emot…  neutral
```

## 0.1 Visualization

[6]:
```
plt.figure(figsize=(6,6), dpi=80)
plt.title("Emotion Count", size=16)
plt.xlabel('Emotions', size = 12)
plt.ylabel('Count', size = 12)
sns.histplot(dataset.Emotions, color='#F19C0E')
```

[6]:
```
<Axes: title={'center': 'Emotion Count'}, xlabel='Emotions', ylabel='Count'>
```




### 0.2 Showing spectrogram and waveplot

[7]:
```
emotion_sad = dataset[dataset['Emotions']=='sad']['Path']
print(type(emotion_sad))
```

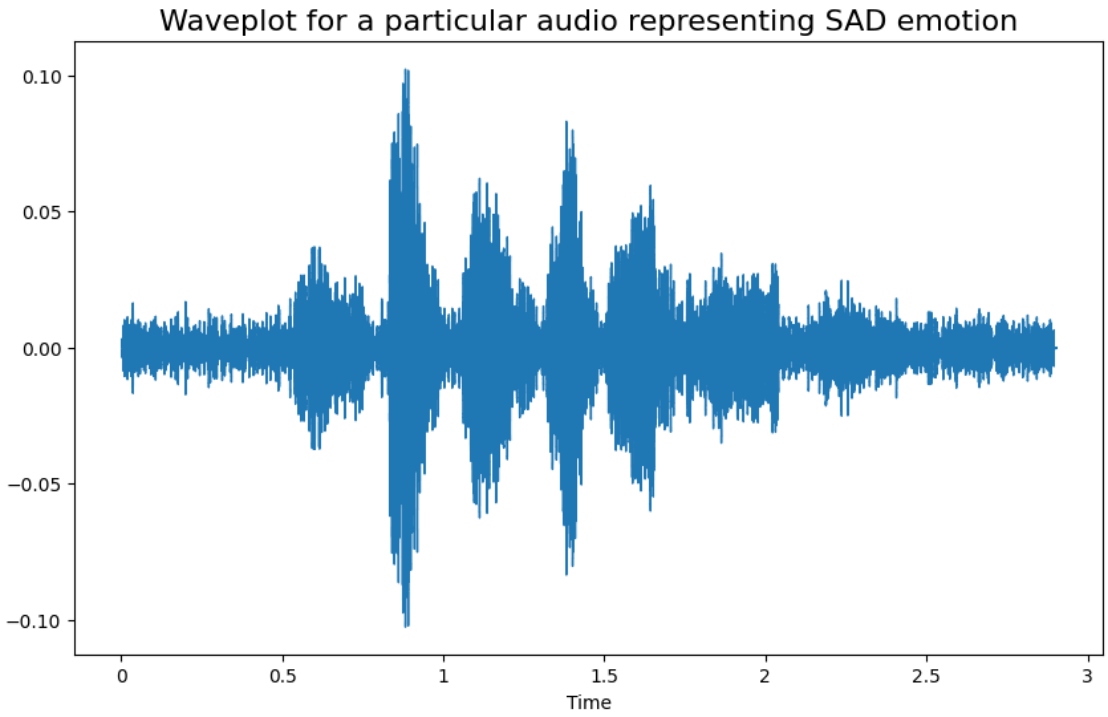
```
<class 'pandas.core.series.Series'>
```

[8]:
```
data_path = emotion_sad.values[542]
data, sampling_rate = librosa.load(data_path)
```

### 0.2.1 Waveplot

[15]:
```
plt.figure(figsize=(10,6))
plt.title("Waveplot for a particular audio representing SAD emotion", size=16)
librosa.display.waveshow(data, sr=sampling_rate)
```

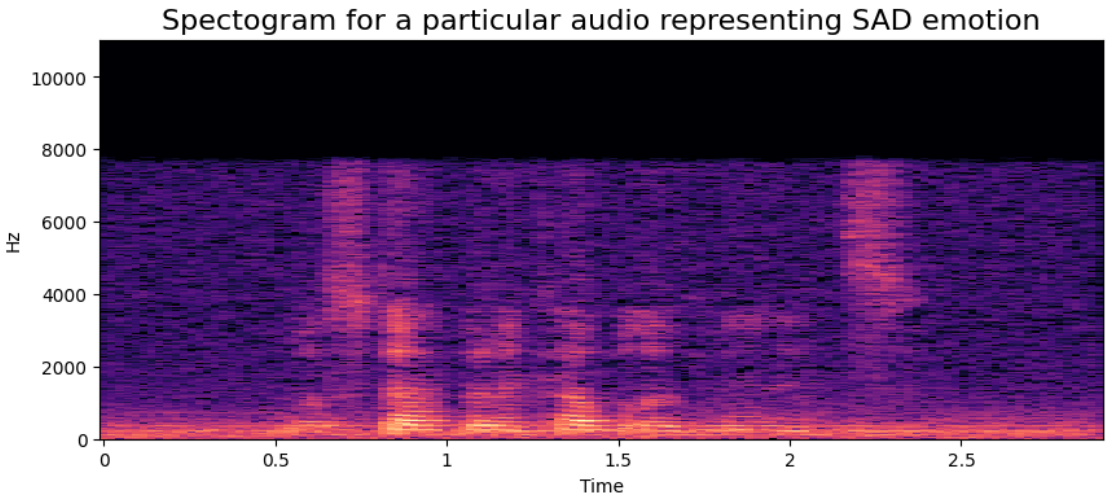
[15]:
```
<librosa.display.AdaptiveWaveplot at 0x215b2752540>
```




### 0.2.2 Spectogram

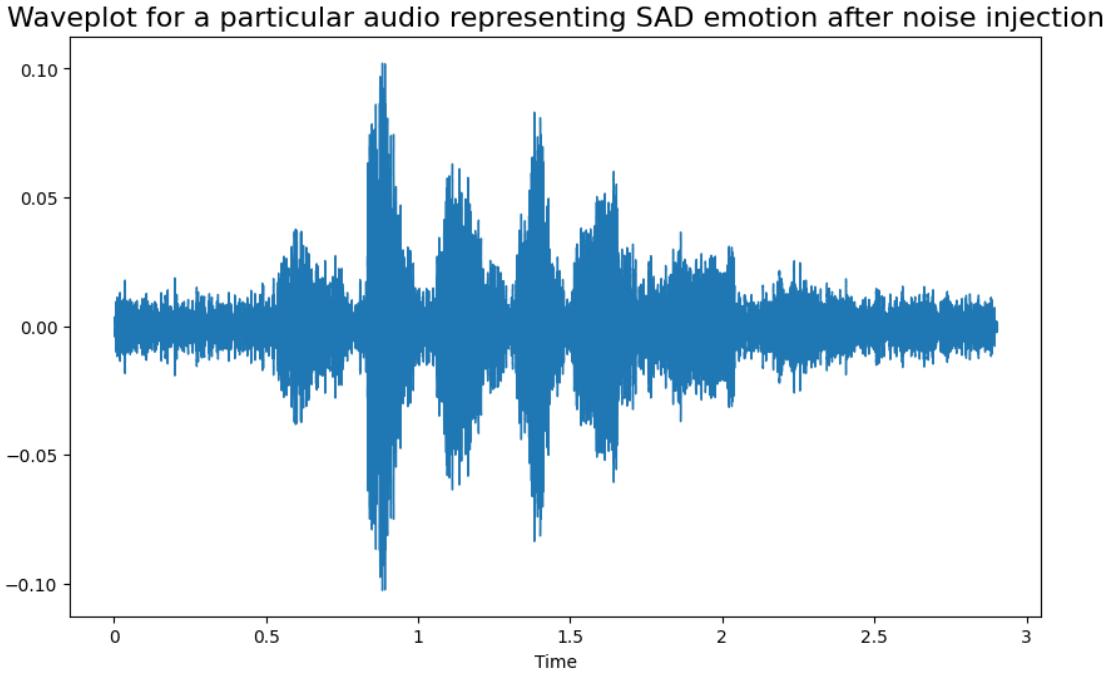
[13]:
```
plt.figure(figsize=(10,4))
plt.title("Spectogram for a particular audio representing SAD emotion", size=16)
D = librosa.stft(data)
S_db = librosa.amplitude_to_db(np.abs(D), ref=np.max)
librosa.display.specshow(S_db, sr = sampling_rate, x_axis='time', y_axis='hz')
```

[13]:
```
<matplotlib.collections.QuadMesh at 0x215b2934170>
```




### 0.3 Augmentation (Noise Injection)

[17]:
```
noise_amp = 0.035*np.random.uniform()*np.amax(data)
audio_injected_data = data + noise_amp*np.random.normal(size=data.shape[0])
plt.figure(figsize=(10,6))
plt.title("Waveplot for a particular audio representing SAD emotion after noise␣
↪injection", size=16)
librosa.display.waveshow(audio_injected_data, sr=sampling_rate)
plt.show()
```



## 0.4 Feature extraction

### 0.4.1 Creating a DF with extracted Feautures

[ ]:
```
X, Y = [], []
print("Feature processing...")

for path, emo, index in zip(dataset.Path, dataset.Emotions,␣
 ↪range(len(dataset))):
    value, sample = librosa.load(path)

    noise_amp = 0.035 * np.random.uniform() * np.amax(value)
    value = value + noise_amp * np.random.normal(size=value.shape[0])

    mfcc = librosa.feature.mfcc(y=value, sr= sample, n_mfcc=13, n_fft=200,␣
 ↪hop_length=512)
    mfcc = np.ravel(mfcc.T)

    mel = librosa.feature.melspectrogram(y=value, sr=sample, hop_length = 256,␣
 ↪n_fft = 512, n_mels=64)
    mel = librosa.power_to_db(mel ** 2)
    mel = np.ravel(mel).T
    result = np.array([])
    result = np.hstack((result, mfcc, mel))

    result = np.array(result)
    X.append(result)
    Y.append(emo)
```

```
Feature processing...
```

[16]:
```
extracted_audio_df = pd.DataFrame(X)
extracted_audio_df["emotion_of_audio"] = Y
print(extracted_audio_df.shape)
print(extracted_audio_df.tail(10))
extracted_audio_df = extracted_audio_df.fillna(0)
```

```
(7442, 30457)
                0          1          2          3          4          5  \
7432 -681.373551 -82.840426  13.205020  27.770437  18.854283  16.468140
7433 -834.295720   0.242970  31.442112  21.022335 -14.324192 -18.603096
7434 -805.844113 -20.488974   0.710674  32.114665  -7.145606   8.435484
7435 -715.355859  -9.410126  -3.380515   8.170915  -7.560497  -8.925686
7436 -687.339699 -35.639018  19.602638  14.008579  -9.161693   7.433288
7437 -774.975083  18.806566  19.309730  23.059738  -8.494374  11.543960
```

```
7438 -775.002614 -24.210463  22.741901  31.035140   9.789918  -9.133600
7439 -557.279910 -95.991817 -12.337064  27.765570  21.020765  10.942931
7440 -641.244277 -73.803682 -11.899944   4.443059  28.696044  -0.088765
7441 -549.762427 -85.807858 -28.495460  22.738892  21.660334 -14.038658

              6          7          8          9  …  30447  30448  30449  \
7432 -11.831021 -29.358461  -2.281565  17.875039  …    NaN    NaN    NaN
7433  -1.469617  -1.853887 -16.956409 -15.401847  …    NaN    NaN    NaN
7434  -5.482810  -1.248952 -15.040162 -21.635647  …    NaN    NaN    NaN
7435  -3.817427 -10.141425 -12.142844   1.899138  …    NaN    NaN    NaN
7436  -7.361370  -8.511002  -1.631311   4.884304  …    NaN    NaN    NaN
7437   4.448506   9.433127 -13.726099   0.628715  …    NaN    NaN    NaN
7438 -16.262439 -27.027029  -1.422697  21.425235  …    NaN    NaN    NaN
7439  -4.662213  -9.642813 -13.106228  -0.336386  …    NaN    NaN    NaN
7440   1.010226 -14.342942 -14.808796   3.301555  …    NaN    NaN    NaN
7441   0.186578  15.678929  -6.990478   9.062540  …    NaN    NaN    NaN

      30450  30451  30452  30453  30454  30455  emotion_of_audio
7432    NaN    NaN    NaN    NaN    NaN    NaN           neutral
7433    NaN    NaN    NaN    NaN    NaN    NaN               sad
7434    NaN    NaN    NaN    NaN    NaN    NaN               sad
7435    NaN    NaN    NaN    NaN    NaN    NaN           neutral
7436    NaN    NaN    NaN    NaN    NaN    NaN           neutral
7437    NaN    NaN    NaN    NaN    NaN    NaN           disgust
7438    NaN    NaN    NaN    NaN    NaN    NaN              fear
7439    NaN    NaN    NaN    NaN    NaN    NaN             happy
7440    NaN    NaN    NaN    NaN    NaN    NaN             happy
7441    NaN    NaN    NaN    NaN    NaN    NaN             angry

[10 rows x 30457 columns]
```

### 0.5 Training

[17]:
```
X = extracted_audio_df.drop(labels='emotion_of_audio', axis= 1)
Y = extracted_audio_df['emotion_of_audio']

x_train, x_test, y_train, y_test = train_test_split(np.array(X), Y, test_size=0.
 ↪2)
```

[18]:
```
from sklearn.preprocessing import StandardScaler
from sklearn.neural_network import MLPClassifier
from sklearn.metrics import accuracy_score


scaler = StandardScaler()
x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)
```

### 0.6 Model creation and fitting

[19]:
```
mlp_model = MLPClassifier(activation='relu',
                          solver='sgd',
                          hidden_layer_sizes=100,
                          alpha=0.839903176695813,
                          batch_size=150,
                          learning_rate='adaptive',
                          max_iter=100000)
mlp_model.fit(x_train,y_train)
```

[19]:
```
MLPClassifier(alpha=0.839903176695813, batch_size=150, hidden_layer_sizes=100,
              learning_rate='adaptive', max_iter=100000, solver='sgd')
```

### 0.7 Accuracy calculation

[20]:
```
y_pred = mlp_model.predict(x_test)
accuracy=accuracy_score(y_true=y_test, y_pred=y_pred)
print("\nModel:{}    Accuracy: {:.2f}%".
          format(type(mlp_model).__name__ , accuracy*100))
```

```
Model:MLPClassifier    Accuracy: 40.09%
```

### 0.8 Prediction verification

[21]:
```
print("The Prediction Made By Model: ")
print("<<<=========================================>>>")
df = pd.DataFrame({'Actual': y_test, 'Predict': y_pred})
print(df.head())
```

```
The Prediction Made By Model:
<<<=========================================>>>
       Actual  Predict
1011    angry    angry
1689  neutral  neutral
6092    angry    angry
6231    angry  disgust
7334  neutral  disgust
```

[ ]: