

## MCA Assignment 2

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### Problem 1

Implemented functions to create and plot spectrograms with varying sample rate and window size.

### Problem 2

Implemented function to calculate MFCC feature set.

### Problem 3

- Trained an SVM model (Polynomial kernel) on 1,000 .wav files (100 from each class) and achieved an accuracy of 51% for Spectrogram feature set.

The precision scores are as follows:

```
[0.5, 0.36842105, 0.36363636, 0.5, 0.66666667, 0.66666667, 1., 0.75, 0.42105263, 0.66666667]
```

The recall scores are as follows:

```
[0.6, 0.7, 0.4, 0.7, 0.4, 0.2, 0.6, 0.3, 0.8, 0.4]
```

- Trained an SVM model (Polynomial kernel) on 10,000 .wav files (1,000 from each class) and achieved an accuracy of 80.08% for MFCC feature set.

The precision scores are as follows:

```
[0.92857143, 0.8018018, 0.7184466, 0.74509804, 0.91919192, 0.82828283, 0.82978723, 0.75, 0.76842105, 0.8021978]
```

The recall scores are as follows:

```
[0.91, 0.89, 0.74, 0.76, 0.91, 0.82, 0.78, 0.81, 0.73, 0.73]
```

- Trained an SVM model (Polynomial kernel) on 1,000 .wav files (100 from each class) and achieved an accuracy of 64% for MFCC feature set.

The precision scores are as follows:

```
[0.83333333, 0.75, 0.53846154, 0.66666667, 1., 0.53846154, 0.33333333, 0.72727273, 0.4, 0.66666667]
```

The recall scores are as follows:

```
[1., 0.6, 0.7, 0.6, 0.8, 0.7, 0.4, 0.8, 0.2, 0.6]
```

As can be seen from the above results, MFCC features sets gave a better result than Spectrogram feature sets on the same training and validation data.

## With noise

Due to time constraint, only trained SVM model on 100 .wav files (10 from each class) for Spectrogram. Validation set was taken as 50 (5 from each class).

For MFCC, trained on 10,000 .wav files (1,000 from each class). Validation set was taken as 1,000 (100 from each class).

Noise was added to both training and validation sets. Ratio of sound to noise was 4:1.

With Spectrogram, got an accuracy of 9%.

```
Precision: [0.      , 0.      , 0.      , 0., 0. ,  
            0.      , 0.      , 0.12121212, 0., 0. ]
```

```
Recall: [0., 0., 0., 0., 0., 0., 0., 0., 0.8, 0.]
```

With MFCC, got an accuracy of 16.5%. (100 .wav files)

```
Precision: [0.15384615, 0.27272727, 0.      , 0.15384615, 0.23076923,  
            0.      , 0.16666667, 0.28571429, 0.28571429, 0.      ]
```

```
Recall: [0.2      , 0.33333333, 0.      , 0.25      , 0.3      ,  
         0.      , 0.125      , 0.2      , 0.22222222, 0.      ]
```

With MFCC, got an accuracy of 61.9%. (10,000 .wav files)

```
Precision: [0.6875      , 0.56756757, 0.47863248, 0.6043956 , 0.71      ,  
            0.61797753, 0.62745098, 0.64761905, 0.62      , 0.66292135]
```

```
Recall: [0.66, 0.63, 0.56, 0.55, 0.71, 0.55, 0.64, 0.68, 0.62, 0.59]
```

It can be seen that MFCC performs better again.