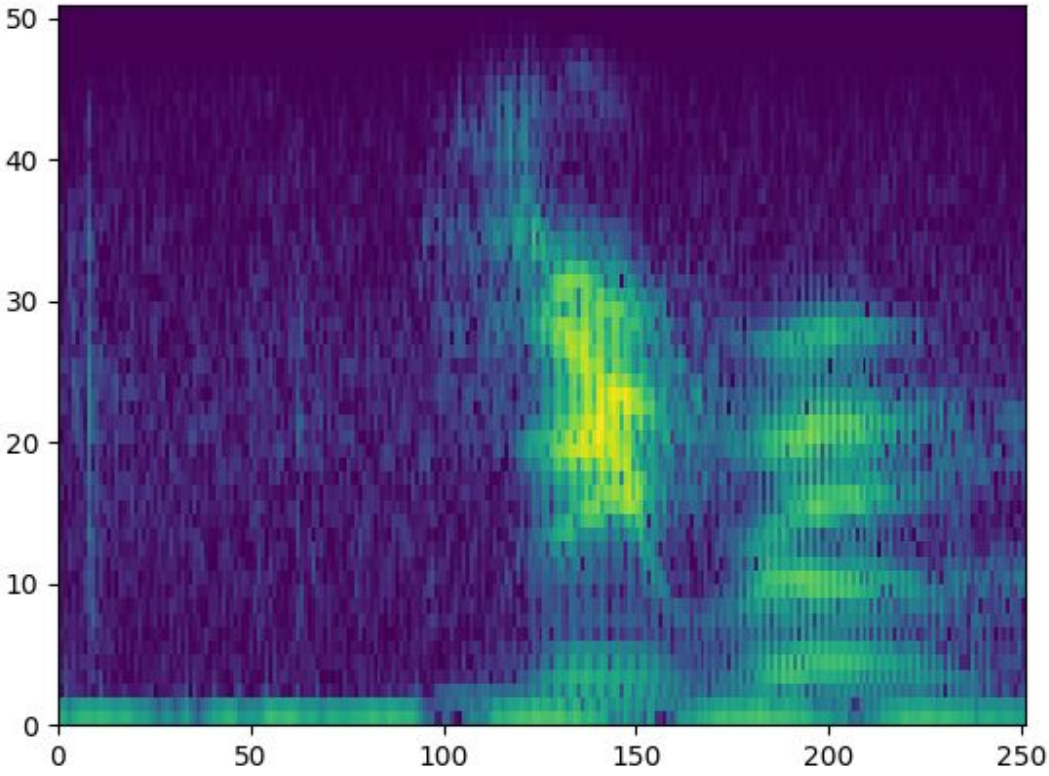
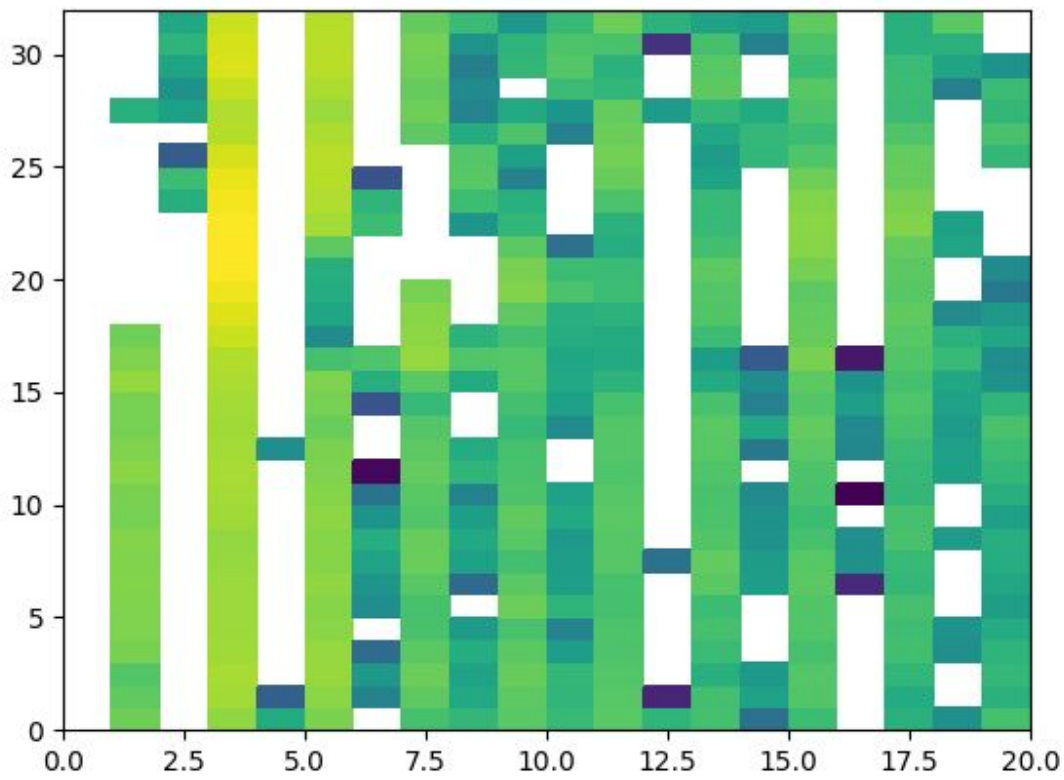
Assignment 2

1. Spectrogram
    a. Code written in question1.py



2. MFCC written in question2.py
   Sample:



3. Analysis on four models. [question3.py]

   Report of classification

   1. with Noise + spectrogram

precision	recall	f1-score	support
0	0.74	0.50	0.59	260
1	0.48	0.36	0.41	230
2	0.37	0.43	0.40	236
3	0.51	0.56	0.53	248
4	0.63	0.59	0.61	280
5	0.51	0.65	0.57	242
6	0.67	0.72	0.69	262
7	0.73	0.55	0.63	263

8	0.41	0.68	0.51	243
9	0.59	0.38	0.46	230
accuracy			0.55	2494
macro avg	0.56	0.54	0.54	2494
weighted avg	0.57	0.55	0.55	2494

2. with Noise + mfcc

precision	recall	f1-score	support
0	0.57	0.50	0.53	260
1	0.32	0.24	0.28	230
2	0.36	0.27	0.31	236
3	0.53	0.31	0.39	248
4	0.73	0.44	0.55	280
5	0.47	0.61	0.53	242
6	0.52	0.75	0.62	262
7	0.61	0.52	0.56	263
8	0.53	0.39	0.45	243
9	0.33	0.71	0.45	230
accuracy			0.48	2494
macro avg	0.50	0.48	0.47	2494
weighted avg	0.50	0.48	0.47	2494

3. without Noise + spectrogram

precision	recall	f1-score	support
0	0.69	0.67	0.68	260
1	0.50	0.51	0.50	230
2	0.47	0.32	0.38	236
3	0.53	0.62	0.57	248
4	0.60	0.72	0.66	280
5	0.62	0.60	0.61	242
6	0.64	0.76	0.69	262

7	0.72	0.61	0.66	263
8	0.52	0.58	0.55	243
9	0.60	0.46	0.52	230
accuracy			0.59	2494
macro avg	0.59	0.58	0.58	2494
weighted avg	0.59	0.59	0.59	2494

4. without Noise + mfcc

precision	recall	f1-score	support
0	0.72	0.55	0.63	260
1	0.32	0.56	0.41	230
2	0.46	0.20	0.28	236
3	0.49	0.52	0.50	248
4	0.73	0.54	0.62	280
5	0.61	0.48	0.54	242
6	0.53	0.80	0.64	262
7	0.74	0.48	0.58	263
8	0.43	0.51	0.47	243
9	0.48	0.57	0.52	230
accuracy			0.52	2494
macro avg	0.55	0.52	0.52	2494
weighted avg	0.56	0.52	0.52	2494

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Here we see that spectrogram has outperformed mfcc as the spectrogram has a huge no. of features(~10-15k) while the mfcc has very small number of features (500 - 800).
The mfcc also needed a lot of regularization in order to run perfectly. The spectrogram took a large amount of time in training due to more no. of features in it.
Overall we can see that the f1 score in each case is least for **class 2**. Hence the prediction accuracy for 2 is very less.
And **class 6** has the best results.