Q3

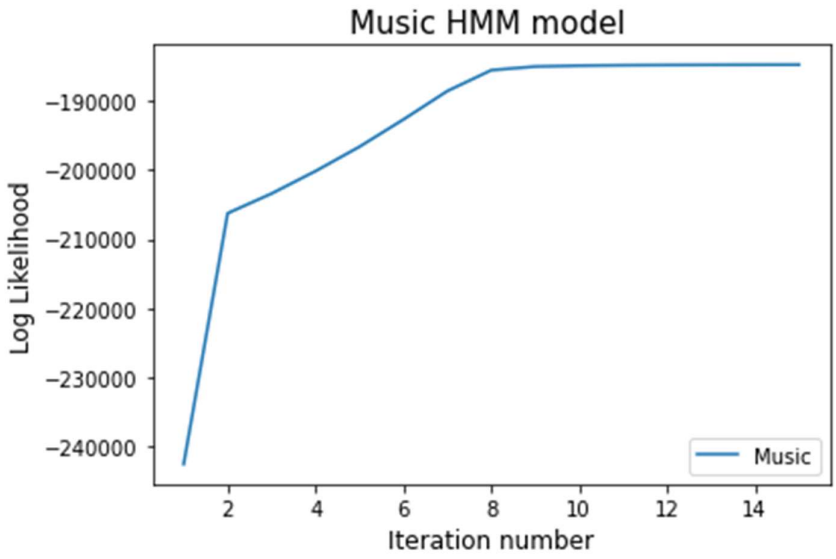
a. Taking first file from both music and speech folders
Likelihood of music is -5405.557164
Likelihood of speech is -6215.268952
Likelihood of music files is more than likelihood of speech file. For this random example, given model fits better to music file.

b. Forward and backward approach gives nearly similar likelihood for same files.

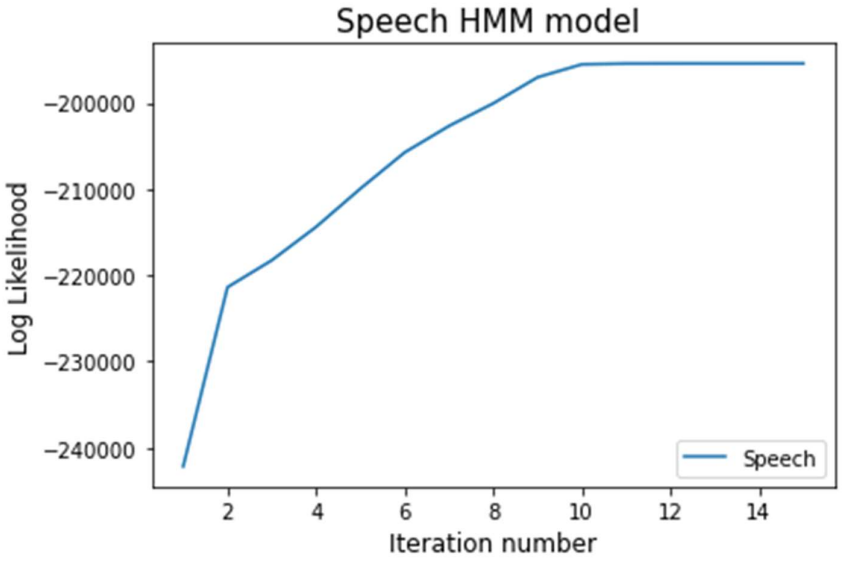
Forward approach	Backward approach
-5405.557164	-5403.236659
-6130.004754	-6127.670285
-6587.962875	-6583.584463
-6165.77913	-6162.07541
-5969.483445	-5967.120384

From the above table, we can see that for same file we get nearly similar likelihood.

c. EM algorithm improves likelihood in each iteration.
I run the EM algorithm for 15 iterations. Log likelihood curve is converging for each iteration.
Log Likelihood curve for Music HMM model:



Log Likelihood curve for Speech HMM model:



d. Training Accuracy: 88.75%
Testing Accuracy: 77%

Confusion Matrix

		True class	
		Music	Speech
Predicted Class	Music	22	9
	Speech	2	15

- Files incorrectly classified as music: 28, 32, 35, 36, 37, 42, 43, 44, 46.
- Files incorrectly classified as speech: 17, 22