DSP 2020 Homework 1

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I mainly break this homework into two c files, train.c and test.c respectively.

1 Training HMM

In train.c, I break the training procedure of Baum-Welch algorithm into several functions to calculate α, β, γ, and ϵ separately.

First, I write forward and backward algorithms according to the equation listed in page 9 and page 10 of the homework assignment. The problem that I encounter is the logical error of my dynamic programming for each state. I forgot to add the initialization for the start of each state, causing the parameters to be accumulated during update. When the first time I go back and check the code in train.c is the testing results of the testing sequences. The results come out that all the testing results are all model_01.txt. Then, I open the debugger to check for the each step to calculate the parameters, and it turns out that the α and β are too big while the state get higher and higher.

After calculating α and β, I calculate the γ value also according to the equation listed in page 11 of the homework assignment by α and β matrices calculated from above. At the meantime, I also record the γ value with different observations, and this matrix help us to update HMM model at the last state. Last, I calculate the ϵ value also according to the equation listed in page 12 of the homework assignment by the given α and β matrices. Also, as in the γ, I also record the ϵ value with different states.

2 Testing HMM

In test.c, I write the Viterbi algorithm as a function according to the equation listed in page 17 of the homework assignment. The problem that I encounter here is the index for δ value in the for loop, because there is too many nested for loop while calculating the δ value. I encounter many times with indexing out of matrix, causing the compile error while compiling.