DSP HW1 Report

b08902045 資工四 袁紹奇

Code

Train

I use the forward and backward algorithm with dynamic programming to solve alpha and beta. After that, use the result to calculate gamma and epsilon, as the homework slide shows. Note that I defined `all_gamma, observe_gamma, state_gamma, all_epsilon` for the update of model parameters. Please see the code for more details.

Test

I implemented Viterbi algorithm to select the best fit model within the 5 models generated by training stage. I solve delta for each model, and then select the model with the largest likelihood.

Usage

```
1 | $ make
```

make would generated train, test, cal_acc for the calculation of accuraccy.

```
1 | $ ./run.sh 100
```

Run the script to train each model with 100 iterations. After training, the script would run cal_acc to calculate the accuraccy for result and ground truth.
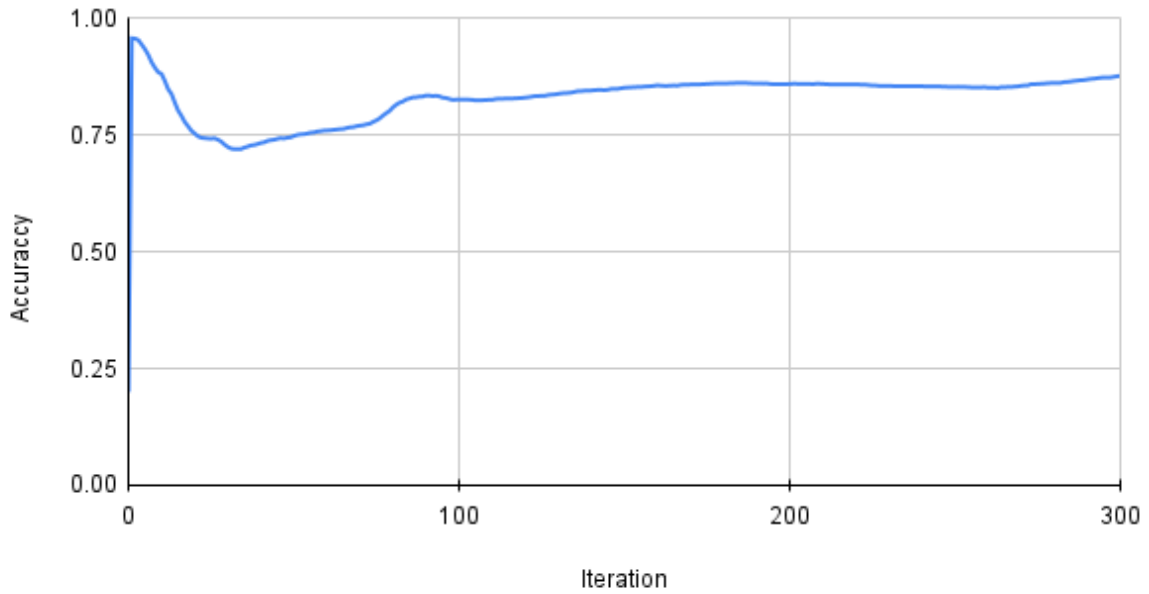
```
1 | $ make clean
```

Run make clean to remove all program and model output. Please check the makefile for details.

Discussion

I run the experiment with different number of iteration, and the result is as follows.

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As we can see, I found it interesting that only a few iteration would make the model perform well, up to 95.8% accuraccy. However, with more iteration the model would converge to a stable accuraccy.

Difficulties

The equation (23) that updates the parameter by calculating sum of gamma, but the equation only adds up to T-1, but I mistaken add to T. It costs me a while until I found this bug.

With N training sequences, we should update parameters from all those sequences

$$\pi'_i = \frac{\sum_{n=1}^{N} \gamma_{n,1}(i)}{N} \tag{22}$$

$$a'_{ij} = \frac{\sum_{n=1}^{N} \sum_{t=1}^{T-1} \epsilon_{n,t}(i,j)}{\sum_{n=1}^{N} \sum_{t=1}^{T-1} \gamma_{n,t}(i)} \tag{23}$$

$$b'_i(k) = \frac{\sum_{n=1}^{N} \sum_{O_{n,t}=k} \gamma_{n,t}(i)}{\sum_{n=1}^{N} \sum_{t=1}^{T} \gamma_{n,t}(i)} \tag{24}$$

Credits

Thanks 施宇飛 for the discussion.