DSP Homework 2

B04902099 資工四 黃嵩仁

Testing Environment：

CSIE workstation

- Linux linux8 4.18.6-arch1-1-ARCH
- gcc 8.2.1

Part 1 – Run Baseline

Screenshot of my result：

```
b04902099@linux8 [~/DSP/dsp_hw2] cat result/accuracy
====================== HTK Results Analysis =======================
  Date: Mon Nov 19 23:07:12 2018
  Ref : labels/answer.mlf
  Rec : result/result.mlf
------------------------ Overall Results --------------------------
SENT: %Correct=38.54 [H=185, S=295, N=480]
WORD: %Corr=96.61, Acc=74.34 [H=1679, D=13, S=46, I=387, N=1738]
===================================================================
```

Baseline accuracy is 74.34%

Part 2 – Improve Accuracy

To improve accuracy, I modify three files：

(a) In lib/proto, I set <NumStates> to **15**

(b) In lib/mix2_10.hed, I increase the number of Gaussian mixture (total 2+8 = **10**) for liN to jiou model.

(c) In 03_training.sh, I set the iterations of Step 1, Step 3 and Step 5 to **20**.

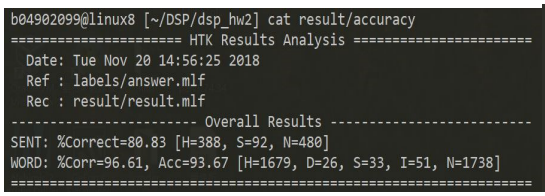
Screenshot of my result：

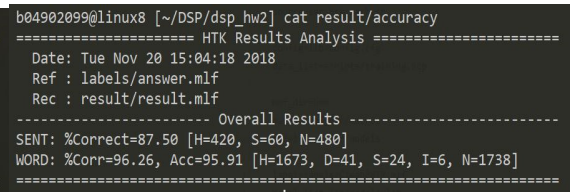
```
b04902099@linux8 [~/DSP/dsp_hw2] cat result/accuracy
====================== HTK Results Analysis =======================
  Date: Tue Nov 20 16:19:25 2018
  Ref : labels/answer.mlf
  Rec : result/result.mlf
------------------------ Overall Results --------------------------
SENT: %Correct=91.88 [H=441, S=39, N=480]
WORD: %Corr=97.58, Acc=97.41 [H=1696, D=34, S=8, I=3, N=1738]
===================================================================
```

Improved accuracy is 97.41%

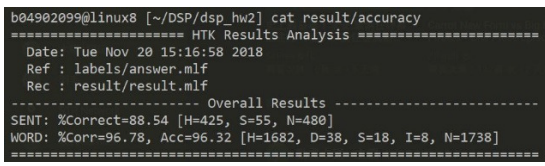
Part 3

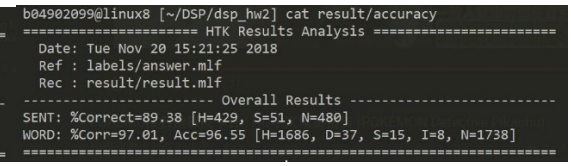
首先，我增加了 Number of state (當 state 的數量增加時，能將訊息分攤，使 model 更精確的描述該 phoneme 的特性)，當 state 個數從原先的 5 增加至 10、15 時，accuracy 分別提高至 93.67%、95.91%。



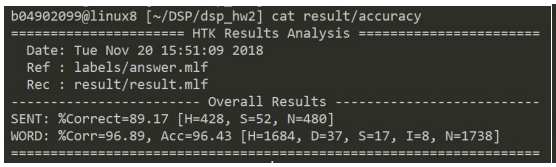


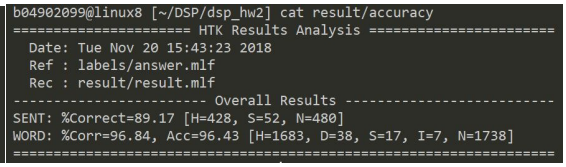
接續上述(# state = 15)，我增加 Gaussian mixtures 的個數 (增加所使用的 Gaussian 數目，能使 model 更精確的描述機率分布)，當 Gaussian mixtures 個數從原先的 2 提升至 5、10 時，accuracy 分別提高至 96.32%、96.55%。

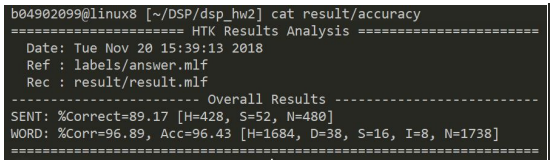


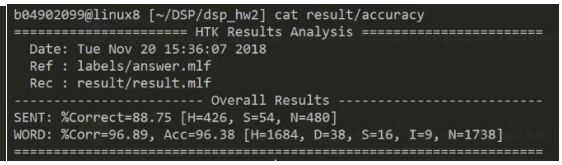


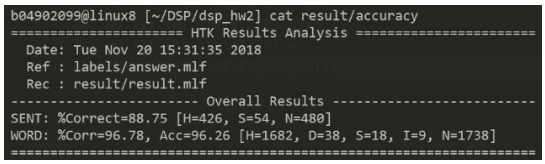
但當我繼續將 Gaussian mixtures 個數提高時，正確率不增反降 (11=>96.43%；12=>96.43%；13=>96.43%；14=>96.38%；15=>96.26%)，推測原因為 Gaussian 數量過多時，會 over fit training data.











最後(# state = 15，#GMM = 10)，我調整 iteration 的數量(增加 iteration 數量能提升收斂程度)，當 iteration 數從原本的 3 增加至 5、10、15、20 時，accuracy 分別提高至 96.49、96.84、97.07、97.41。而當 iteration 數增加至 25 時，accuracy 則會下降至 97.35。

我最後採用# state = 15、#GMM = 10、#iteration = 20，accuracy = 97.41%