在這次作業中我依序更改的參數及效果如下:

nonsilence 跟 silence phones 的總 states 數量都調成 10 個

並且提高 gauss 的初始數量跟最終數量

```
numiters=15                                          # Number of iterations of training
maxiterinc=14                                        # Last iter to increase #Gauss on.
numgauss=100                                         # Initial mm-Gauss (must be more than #states=3*phones).
totgauss=3000                                        # Target #Gaussians.
incgauss=$[($totgauss-$numgauss)/$maxiterinc] # per-iter increment for #Gauss
realign_iters="1 2 3 4 5 6 7 8 9 10 11 12 13 14 15";
scale_opts="--transition-scale=1.0 --acoustic-scale=0.5 --self-loop-scale=0.5"
###
```

transition 則保留原本的設定(如圖)，迴圈設為 15 圈

```
</ForPhones>
<State> 0 <PdfClass> 0 <Transition> 0 0.75 <Transition> 1 0.25 </State>
<State> 1 <PdfClass> 1 <Transition> 1 0.75 <Transition> 2 0.25 </State>
<State> 2 <PdfClass> 2 <Transition> 2 0.75 <Transition> 3 0.25 </State>
<State> 3 <PdfClass> 3 <Transition> 3 0.75 <Transition> 4 0.25 </State>
<State> 4 <PdfClass> 4 <Transition> 4 0.75 <Transition> 5 0.25 </State>
<State> 5 <PdfClass> 5 <Transition> 5 0.75 <Transition> 6 0.25 </State>
<State> 6 <PdfClass> 6 <Transition> 6 0.75 <Transition> 7 0.25 </State>
<State> 7 <PdfClass> 7 <Transition> 7 0.75 <Transition> 8 0.25 </State>
<State> 8 <PdfClass> 8 <Transition> 8 0.75 <Transition> 9 0.25 </State>
<State> 9 <PdfClass> 9 <Transition> 9 0.75 <Transition> 10 0.25 </State>
<State> 10 </State>
</TopologyEntry>
```

準確率從原本的 73 上升到 93.32

```
Generating results for test set with acoustic weight = [ 0.95 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 93.32 ] %
```

所以增加 states 的數量可以有效增加準確率且已經逼近 95%了

接著我再試試看增加更多的 state 看效果會不會更好(增加到 15)

```
<State> 0 <PdfClass> 0 <Transition> 0 0.75 <Transition> 1 0.25 </State>
<State> 1 <PdfClass> 1 <Transition> 1 0.75 <Transition> 2 0.25 </State>
<State> 2 <PdfClass> 2 <Transition> 2 0.75 <Transition> 3 0.25 </State>
<State> 3 <PdfClass> 3 <Transition> 3 0.75 <Transition> 4 0.25 </State>
<State> 4 <PdfClass> 4 <Transition> 4 0.75 <Transition> 5 0.25 </State>
<State> 5 <PdfClass> 5 <Transition> 5 0.75 <Transition> 6 0.25 </State>
<State> 6 <PdfClass> 6 <Transition> 6 0.75 <Transition> 7 0.25 </State>
<State> 7 <PdfClass> 7 <Transition> 7 0.75 <Transition> 8 0.25 </State>
<State> 8 <PdfClass> 8 <Transition> 8 0.75 <Transition> 9 0.25 </State>
<State> 9 <PdfClass> 9 <Transition> 9 0.75 <Transition> 10 0.25 </State>
<State> 10 <PdfClass> 10 <Transition> 10 0.75 <Transition> 11 0.25 </State>
<State> 11 <PdfClass> 11 <Transition> 11 0.75 <Transition> 12 0.25 </State>
<State> 12 <PdfClass> 12 <Transition> 12 0.75 <Transition> 13 0.25 </State>
<State> 13 <PdfClass> 13 <Transition> 13 0.75 <Transition> 14 0.25 </State>
<State> 14 <PdfClass> 14 <Transition> 14 0.75 <Transition> 15 0.25 </State>
<State> 15 </State>
</TopologyEntry>
<TopologyEntry>
```

準確率反而下降了

```
Generating results for test set with acoustic weight = [ 0.95 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 91.65 ] %
```

看來就算一直增加 state 的數量不能一直增加準確率

我把 state 數量調回 10 個但 transition 改為跟後兩個 state 有關

```
<State> 0 <PdfClass> 0 <Transition> 0 0.75 <Transition> 1 0.125 <Transition> 2 0.125</State>
<State> 1 <PdfClass> 1 <Transition> 1 0.75 <Transition> 2 0.125 <Transition> 3 0.125</State>
<State> 2 <PdfClass> 2 <Transition> 2 0.75 <Transition> 3 0.125 <Transition> 4 0.125</State>
<State> 3 <PdfClass> 3 <Transition> 3 0.75 <Transition> 4 0.125 <Transition> 5 0.125</State>
<State> 4 <PdfClass> 4 <Transition> 4 0.75 <Transition> 5 0.125 <Transition> 6 0.125</State>
<State> 5 <PdfClass> 5 <Transition> 5 0.75 <Transition> 6 0.125 <Transition> 7 0.125</State>
<State> 6 <PdfClass> 6 <Transition> 6 0.75 <Transition> 7 0.125 <Transition> 8 0.125</State>
<State> 7 <PdfClass> 7 <Transition> 7 0.75 <Transition> 8 0.125 <Transition> 9 0.125</State>
<State> 8 <PdfClass> 8 <Transition> 8 0.75 <Transition> 9 0.25 </State>
```

結果正確率下降到 63.15

```
Generating results for test set with acoustic weight = [ 0.9 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 63.15 ] %
```

調高 transition 的數量效果極差，所以 transitionn 保留 transist 到下一個就好

Train.sh 跟 topo.proto 的參數都調過了，接下來調調看 test.sh 的參數

先將 acoustic model 的比重調低到 0.75，結果準確率提高到 94.88

```
Generating results for test set with acoustic weight = [ 0.75 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 94.88 ] %
```

再繼續調低到 0.6，準確率 96.32

```
Generating results for test set with acoustic weight = [ 0.6 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 96.32 ] %
```

調低到 0.2

```
Generating results for test set with acoustic weight = [ 0.2 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 97.52 ] %
```

所以一直不斷調低 acoustic 的 weight 就會得到高的準確率? 來試試看一個極端的例子

```
Generating results for test set with acoustic weight = [ 0.001 ]
    output -> viterbi/mono/test.mlf
    log -> viterbi/mono/log/latgen.test.log
    result -> viterbi/mono/test.rec
    accuracy -> [ 7.66 ] %
```

結論: 顯然 acoustic model 並不比 language model 來的重要，但是仍需要 acoustic model 來 model 出聲音的特徵。